COCKER's ARITHMETICK:

BEING

A plain and familiar Method, suitable to the meaneſt Capacity, for the full underſtanding of that incomparable ART, as it is now taught by the ableſt Schoolmaſters in CITY and COUNTRY.

COMPOSED

By EDWARD COCKER, late Practitioner in the Arts of Writing, Arithmetick and Engraving; being that ſo long ſince promiſed to the World.

Peruſed and publiſhed

By JOHN HAWKINS, Writing Maſter, near St. *George's* Church in *Southwark*, by the Author's correct Copy, and commended to the World by many eminent Mathematicians and Writing-Maſters in and near *London*.

The Fiftieth EDITION, carefully corrected and amended. With Notes upon the *Iriſh* Weights and Meaſures, *&c.* By

ISAAC JACKSON, *and Aſſiſtants.*

Licenſed *Sept.* 3, 1677. *Roger L'Eſtrange.*

DUBLIN:

Printed by and for I. JACKSON, at the *Globe* in *Meath-ſtreet.* 1757.

TO his much honoured Friends, *Manwaring Davies* of the *Inner Temple*, Esq; and Mr. *Humphry Davies* of St. *Mary Newington Butts*, in the County of *Surry*. *John Hawkins*, as an Acknowledgment of unmerited Favours, humbly dedicateth this *Manual of Arithmetick*.

To the READER.

Courteous Reader,

I Having had the Happiness of an intimate Acquaintance with Mr. *Cocker* in his Life-time, often sollicited him to remember his Promise to the World, of publishing his *Arithmetick*; but (for Reasons best known to himself) he refused it; and after his Death (the Copy falling accidentally into my Hand) I thought it not convenient to smother a Work of so considerable a Moment, not questioning but it might be as kindly accepted as if it had been presented by his own Hand. The Method is familiar and easy, discovering as well the Theoric as the Practic of that necessary Art of *Vulgar Arithmetick*. And in this new Edition there are many remarkable Alterations for the Benefit of the Teacher or Learner, which I hope will be very acceptable to the World. I have also performed my Promise, in publishing the *Decimal Arithmetick*, which finds Encouragement to my Expectation, and the Booksellers too. I am thine to serve thee,

John Hawkins.

AT the Request of Mr. *Jackson*, I have examined this new Edition of *Cocker*'s Arithmetic: I believe scarce any of the Errors complained of in former Impressions have passed without Amendment, and the Learner may now depend on its Correctness.

May 31, 1757. *G. Minty.*

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CHAP. I.

Notation of Numbers.

ARITHMETICK is an Art of Numbering, or Knowledge, which teacheth to number well. And there are divers Species and Kinds of *Arithmetick* and *Geometry*, the which we do intend to treat of in Order, applying the Principles of the one to the Definition of the other. For as Greatneſs is the Subject of *Geometry*, ſo Number is the Subject of *Arithmetick*; and if ſo, then their firſt Principles and chief Fundamentals muſt have like Definitions, or at leaſt ſome Congruency.

2. Number is that by which the Quantity of any Thing is expreſſed or numbered; as the Unit is the Number by which the Quantity of one Thing is expreſſed or ſaid to be one, and two, by which it is named two, and ½ half, by which it is named or called half, and $\sqrt{3}$ the Root of 3, by which it is called the Root of 3; the like of any other.

3. Hence it is that Unit is Number; for the Part is of the ſame Matter that is its Whole, the Unit is part of the Multitude of Units, therefore the Unit is of the ſame Matter, that is the Multitude of Units; but the Matter of the Multitude of Units is Number; therefore the Matter of Unit is Number; or elſe, if from a Number given no Number be ſubtracted, the Number given remaineth; as ſuppoſe 3 the given Number, if, as ſome ſuppoſe, 1 to be no Number, then if you ſubtract 1 from 3, there muſt remain three ſtill; which is very abſurd.

4. Hence it will be convenient to examine from whence Number hath its Riſe or Beginning. Moſt Authors maintain, that Unit is the Beginning of Number, and itſelf no Number; but looking upon the Principles and Definitions in the firſt Rudiments of Geometry, we ſhall find that the Definition of a Point is no way congruous with the Definition of an Unit in Arithmetick; and therefore One or Unit muſt be in the Bounds or Limits of Number, and conſequently the Beginning of Number is not to be found in the Number 1; wherefore making Number and Magnitude congruent in Principles, and like in Definitions, we make

and constitute a Cypher to be the Beginning of Number, or rather the Medium between encreasing and decreasing Numbers, commonly called absolute or whole Numbers, and negative and fractional Numbers, between *which* nothing can be imagined more *agreeable* to the Definition of a Point in Geometry; for as a Point is an Adjunct of Line, and itself no Line, so is a (o) Cypher an Adjunct of Number, and itself no Number: And as a Point in Geometry cannot be divided or increased into Parts, so likewise (o) cannot be divided or increased into Parts; for as many Points, tho' in Number infinite, do make no Line, so many (o) Cyphers, tho' in Number infinite, do make no Number. For the Line AB cannot be increased by the Addition of the Point C, neither the Number D be increased by the Addition of the (o) Cypher E; for if you add nothing to 6, the Sum will be 6, (o) Cypher neither increasing nor diminishing the Number o; but if it be granted that AB be extended or prolonged to the Point C, so that AC be made a continued Line, then AB is increased by the Addition of the Point C. In like manner, if we grant D (6) to be prolonged to E (o), so that DE (60) be a continued Number, making 60, then (6) is augmented by the Aid of (o) as constituting the Number (60) Sixty: And furthermore, that 1 or Unit is material, in a Number, and that (o) is the Beginning of Number, is proved by all Authors, altho' indirectly; for the Tables of Sines and Tangents prove one Degree to be a Number, because the Sine of 1 Degree is 174524, (the Radius being 1000000) and the Beginning of the Table is (o), and it answereth 000000, *&c.*

A-------B
C
D 6
E o

Sum of 6

A---B---C

DE 06
60

5. Hence it is that Number is not Quantity discontinu'd, for that which is but one Quantity, is not Quantity disjunct: 60 Sixty, as it is a Number, is one Quantity, *viz.* one Number 60 sixty; therefore as it is a Number, it is not Quantity disjunct, for Number is some such Thing in Magnitude; as Humidity in Water; for as Humidity extends itself thro' all and every part of Water, so Number related to Magnitude doth extend itself thro' all and every part of Magnitude: Also, as continued Water doth answer continued Humidity, so to a continued Magnitude doth answer a continued Number. As the continued Humidity of an entire Water suffereth the same Division and Distinction that his Water doth, so the continued Number sufferеth

eth the ſame Diviſion and Diſtinction that his Magnitude doth. And thus much concerning the Definition and Principles of Number and Magnitude. We come now to treat of,

6. The Characters or Notes by which Numbers are ſignified, or by which a Number is ordinarily expreſſed; and they are theſe, *viz.* (0) Cypher or Nothing, 1 One, 2 Two, 3 Three, 4 Four, 5 Five, 6 Six, 7 Seven, 8 Eight, 9 Nine. The Cypher, which tho' of itſelf it expreſſeth not any certain or known Quantity, yet is the Beginning or Root of Number, and the other nine Figures are called ſignificant Figures or Digits.

7. In Number of any Sort two Things are to be conſidered, *viz. Notation* and *Numeration.*

8. *Notation* teacheth how to deſcribe any Number by certain Notes and Characters, and to declare the Value thereof, being ſo deſcribed, that is by Degrees and Periods.

9. A Degree conſiſts of 3 Figures, *viz.* of three Places, comprehending Units, Tens and Hundreds, ſo 365 is a Degree, and the firſt Figure (5) on the right Hand, ſtands ſimply for its own Value, being Units, or ſo many Ones, *viz.* five; the ſecond in Order from the Right, ſignifies as many times Ten as there are Units contained in it, *viz.* ſixty; the third in the ſame Order ſignifies ſo many Hundreds as it contains Units, ſo will the Expreſſion of the Number be Three hundred ſixty five, *&c.*

10. A Period is when a Number conſiſts of more than 3 Figures or Places, and whoſe proper Order is to prick every third Place, beginning at the right Hand, and ſo on to the left; ſo the Number 63452 being given, it will be diſtinguiſhed thus, 63,452, and expreſſed thus, ſixty three thouſand four hundred fifty two; likewiſe 4,578,236,782, being diſtinguiſhed as you ſee, will be expreſſed thus, four thouſand five hundred ſeventy eight millions, two hundred thirty ſix thouſand, ſeven hundred eighty two.

11. Number is either Abſolute or Negative.

12. Abſolute, intire, whole, increaſing Number, is that by which annexing another Figure or Cypher, it becomes ten times as much as it ſtood for before; and if two Figures or Cyphers be annexed, it makes an hundred times as much as it ſtood for before, *&c.* as if you annex to the Figure 6 a Cypher, then it will be (60) ſixty; ſo if two Cyphers are annexed, then it will be (600) ſix hundred, and if you do annex to it (4) four, then it will be (64) ſixty four, and if you annex (78) ſeventy eight, it will be then (678) ſix hundred ſeventy eight, *&c.*

13. A

13. A negative or broken, fractional, decreasing Number, is that by which prefixing a Point or Prick toward the left Hand, its Value has decreased from so many Units to so many tenth Parts of any Thing; and if a Point and (o) Cypher, or Digit, be prefixed, it will be then so many hundred Parts; and if a Point and two Cyphers or Digits be prefixed, its Value is decreased to be so many thousandth Parts; as if you would prefix before the Figure 3 a Point (.) or Prick thus (.3) it is then decreased from 3 Units or 3 Integers, to 3 tenth Parts of an Unit or an Integer; and if you prefix a Point and Cypher thus (.03) it is decreased from 3 Integers to 3 hundred Parts of an Integer; and by this Means 5*l.* absolute, by prefixing of a Point, will be decreased to 5*l.* negative, which is 5 tenth Parts of a Pound, equal in value to ten Shillings, and so by prefixing of more Cyphers or Digits, its Value is decreased in a decuple Proportion *ad infinitum*. As in the following Scheme, or rather Order of Numbers, we have placed (o) Cypher in its due Place in Order, as it is in the Beginning and Medium of Number; for going from (o) towards the left Hand, you deal with intire, absolute, whole, increasing Numbers.

Increasing Numbers.						Decreasing Numbers.			
25	629	876	543	21012	345	678	976	3
mmm	mmm	mmm	mmm	CXUXC	mmm	mmm	mmm	m
mm	mmm	mmm	CX		XC	mmm	mmm	m
mm	mmm	CX				XC	mmm	m
mm	CX						XC	m
X.								M

But going from (o) the Place of Units towards the right Hand, you meet with broken, negative, fractional and decreasing Numbers. And hence it follows, that *Multiplication* increaseth the Product in absolute Numbers, but decreaseth the Product in negative Numbers; also Division decreaseth the Quotient in whole Numbers, and increaseth it in negative fractional Numbers.

14. An absolute, intire, whole, increasing Number, always a Point annexed towards the right Hand; and therefore,

15. A negative, broken, decimal, decreasing Number, hath always a Point prefix'd towards the left Hand. When we express Integers or whole Numbers, as 5 *Pounds*, 5 *Feet*, 26 *Men*, we usually annex a Point or Prick after the Number, thus,

l. feet. men. inch.
5. 5. 26. 347.

But

But when we expreſs Decimals, or Numbers that are denied to be intire, or decreaſing Numbers, we do commonly prefix a Point or Prick before the ſaid Decimal or decreaſing Number, thus (.3) that is, 3 Tenths, or 3 Primes (.03) that is 3 Hundredths, or 3 Seconds.

16. A whole or abſolute Number is a Unit, or a compoſed Multitude of Units, and it is either a Prime or elſe a compound Number.

17. Prime Numbers amongſt themſelves, are thoſe which have no Multitude of Units for a common Meaſure, as 8 and 7, or 10 and 13, becauſe not any Multitude of Units can equally meaſure or divide them without a Remainder.

18. Compound Numbers amongſt themſelves, are thoſe which have a Multitude of Units for a common Meaſure, as 9 and 12, becauſe 4 meaſures them exactly, and abbreviates them to three and four.

19. A broken Number, commonly called a Fraction, is a Part or Parts of a whole Number, *viz.* A Part of an Integer, as $\frac{1}{3}$ one Third, is one third Part of an Unit.

20. A broken Number or Fraction conſiſts of two Parts, *viz.* the Numerator and Denominator.

21. The Numerator and Denominator of a Fraction are ſet one over the other, with a Line between them; and the Numerator is ſet above the Line, and expreſſeth the Parts therein contained.

22. The Denominator of a Fraction, is the inferior Number placed below the Line, and expreſſeth the Number of Parts, into which the Unit or Integer is divided; and let $\frac{3}{4}$ be the Fraction given, ſo ſhall 3 be the Numerator, and doth expreſs or number the Multitude of Parts contained in this Fraction; for $\frac{3}{4}$ is a Fraction compounded of Fourths or Quarters, and the Figure 3 in numbering ſhews us, that in that Fraction there are 3 of the 4 Parts or Quarters, alſo in the ſame Fraction, 4 is the Denominator, and doth expreſs the Quality of the Fraction, *viz.* that the Whole or Integer is divided into 4 equal Parts.

23. A broken Number is either proper or improper, *viz.* proper when the Numerator is leſs than the Denominator, for $\frac{3}{4}$ is a perfect proper Fraction, but an improper Fraction hath its Numerator greater, or at leaſt equal to the Denominator, thus $\frac{4}{4}$ is an improper Fraction, the Reaſon is given in the Definition.

24. A

24. A proper broken Number is either ſimple or compound, *viz.* ſimple when it hath one Denomination, and compound when it conſiſteth of divers Denominations; if $\frac{3}{4}$, $\frac{6}{12}$, $\frac{25}{100}$ were given, we ſay they are each of them ſingle or ſimple Fractions, becauſe they conſiſt but of one Numerator and one Denominator; but if $\frac{3}{4}$ of $\frac{6}{12}$ of $\frac{25}{100}$ of a Pound ſterling were given, we ſay that it is a compound broken Number or Fraction, becauſe the Expreſſion and Repreſentation conſiſteth of more Denominations than one, and ſuch by ſome are called Fractions of Fractions; they have always this Particle (of) between them.

25. When a ſingle broken Number or Fraction hath for his Denominator a Number conſiſting of a Unit in the firſt Place towards the left Hand, and nothing but Cyphers from the Unit towards the right Hand, it is then the more aptly and rightly called a Decimal Fraction; under this Head are all our decreaſing Numbers placed, and in our 13th Definition, called Negative; and by the Order there preſcribed, we order them to be Decimals, by ſigning a Prick or Point before them, or the Numerator, rejecting the Denominator; therefore according to our laſt Rule, $\frac{5}{10}$ $\frac{5}{100}$ $\frac{25}{1000}$, are then ſaid to be Decimals; and a Decimal Fraction may be expreſſed without its Denominator (as before) by prefixing a Point or Prick before the Numerator of the ſaid Fraction, and then ſhall the former Fractions $\frac{5}{10}$ and $\frac{25}{1000}$ ſtand thus, .5, and .025.

But oftentimes, as in the ſecond and fourth Fractions, $\frac{5}{100}$ and $\frac{25}{1000}$, a Prick or Point will not do without the Help of a Cypher or Cyphers prefixed before the ſignificant Figures of the Numerator, and therefore when the Numerator of a Decimal Fraction conſiſteth not of ſo many Places as the Denominator hath Cyphers, fill up the void Places of the Numerator with prefixing Cyphers before the ſignificant Figures of the Numerator, and then ſign it for a Decimal, ſo ſhall $\frac{5}{100}$ be .05, and $\frac{25}{1000}$ will be .025, and $\frac{72}{10000}$ will be .0072. Now by this we may eaſily diſcover the Denominator; having the Numerator, for always the *Denominator* of any Decimal Fraction conſiſts of ſo many Cyphers as the Numerator hath

hath Places, with an Unit prefixed before the ſaid Cyphers, *viz.* under the Point or Prick.

26. A Decimal Number or Fraction, is expreſſed by Primes, Seconds, Thirds, Fourths, *&c.* and its Number decreaſing. Here inſtead of natural and common Fractions, as $\frac{3}{4}$ of a Thing, we order the Thing or Integer into Primes, Seconds, Thirds, Fourths, Fifths, *&c.* that our Expreſſion may be conſonant to our former Order.

27. In Decimal Arithmetick we always imagine that all intire Units, Integers and Things are divided firſt into ten equal Parts, and theſe Parts ſo divided we call Primes, and Secondly, we divide alſo each of the former Primes into other ten equal Parts, and every one of theſe Diviſions we call Seconds; and Thirdly, we divide each of the ſaid Seconds into ten other equal Parts, and thoſe ſo divided we call Thirds: and ſo by decimating the former, and ſubdecimating theſe latter, we run on *ad infinitum*.

28. Let a Pound *Sterling*, *Troy-weight*, *Averdupois-weight*, *Liquid-meaſure*, *Dry-meaſure*, *Long-meaſure*, *Time*, *Dozen*, or any other Thing or Integer be given to be decimally divided: In this Notion premiſed, we ought to let the firſt Diviſion be Primes, the next Diviſion Seconds, the next Thirds, *&c.* ſo one Pound *Sterling* being 20 Shillings, which divided into ten equal Parts, the Value of each Part will be two Shillings, therefore one Prime of a Pound *Sterling* will ſtand thus (.1) which is in Value 2 Shillings, 3 Primes will ſtand thus (.3) and that is in Value 6 Shillings. Again, a Prime, or .1 being divided into ten equal Parts, each of thoſe Parts will be one Second, and is thus expreſſed (.01) and its Value will be found 2*d.* Farthing and $\frac{6}{10}$ of a Farthing; and ſo will .05 ſignify one Shilling or five Seconds: And if .01 be divided into ten other equal Parts, each of thoſe Parts ſo divided will be Thirds, and will ſtand thus .001, and its Value will be found to be .96 of a Farthing, or $\frac{96}{100}$ of a Farthing, and .009 Thirds will be 2*d.* and .64 of a Farthing, or $\frac{64}{100}$ of a Farthing; ſo that 375*l.* will be found to repreſent 7*s.* 6*d.* for the 3 Primes are 6*s.* and the 7 Seconds are 1*s.* 4*d.* and $\frac{8}{10}$ of a Penny, and the 5 Thirds are 1 Penny $\frac{1}{10}$ of a Penny, both which added together make 7*s.* 6*d.*

29. If you put any Bulk or Body repreſenting an Integer, and it be decimally divided, then the Parts in the firſt

Decimation

Decimation are Primes, the next Seconds, and the next Decimation is Thirds, the next Fourths, *&c.* As let there be given a Bullet of Lead, or ſuch like, whoſe Weight let it be 50lb *Troy*, this is called an Unit, Integer or Thing; then will the like Weight and Matter make 10 other, the which together will be equal to 50lb and will weigh each of them 5lb a-piece; take of the ſame Matter, and equal to 5lb make 10 more, then each of thoſe weigh 6 Ounces a-piece; alſo, if again you take 6 Ounces and thereof make 10 other ſmall Bullets, each of them will weigh 12 Penny-weight *Troy*; and thus have you made Primes, Seconds and Thirds, in reſpect of the Integer, containing 50lb *Troy-weight*; ſo that 5 Primes is equal to the half Maſs, and 2 Primes, and 5 Seconds is a quarter of the Maſs; and therefore one of the firſt Diviſion, two of the ſecond Diviſion, and five of the third Diviſion, will be equal in Weight to half a quarter of the Maſs, and contains 6lb 3 *oz.*

30. When a decimal Fraction followeth a whole Number, you are to ſeparate or part the Decimal from the whole Number by a Point or Prick; ſo if .75 follow the whole Number 32, ſet them thus, 32.75. You ſhall find that divers Authors have diverſe Ways in expreſſing mix'd Numbers; as thus, 32|75, or 32|$\frac{75}{00}$, or 32$\frac{\cdot}{\cdot}$75, but you will find that 32.75, thus placed and expreſſed, is the fitteſt for Calculation.

31. A mix'd Number hath two Parts, the whole and the broken; the whole is that which is compoſed of Integers and the broken is a Fraction annexed thereunto. So the mix'd Number 36$\frac{8}{12}$ being given, we ſay, that 36 is the whole Number, which is compoſed of Integers, and the $\frac{8}{12}$ is the broken Number annexed, which ſheweth that one of the former Integers (of that 36) being divided into 12 Parts, this $\frac{8}{12}$ doth expreſs 8 of thoſe 12 Parts more, belonging to the ſaid 36 Integers.

32. Denominative Numbers are of one, or of many, and thoſe are of diverſe Sorts and Kinds, *viz.* Singular, called Unit, as 1; and Plural a Multitude, as 2, 3, 4, 5: Single, of one Kind only called Digits, as 1, 2, 3, 4, 5, 6, 7, 8, 9, and Compounds of many, 10, 11, 12, *&c.* 102, 367, *&c.*

Proportional, as Single, Multiple, Double, Triple, Quadruple, *&c.* Denominate, as Pounds, Shillings, Pence; Undenominate, as 1, 2, 3, *&c.* Perfect, as 6, 28, 496,

And therefore,

laſt 1	*wey* 2	*qrs.* 5	*combs* 2	*buſh.* 4	*pecks* 4	*gal.* 2	*pints* 8
1	2	10	20	80	320	640	5120
	1	5	10	40	160	320	2560
		1	2	8	32	64	512
			1	4	16	32	256
				1	4	8	64
					1	2	16
						1	8

8. The leaſt denominative Part of Long-meaſure is a Barly-corn well dried, and taken out of the Middle of the Ear, whoſe Table of Parts followeth.

3 Barly-corns	make	1 Inch
12 Inches		1 Foot
3 Feet		1 Yard
3 Feet 9 Inches		1 Ell *Engliſh*
6 Feet		1 Fathom
5 Yards ½ in *England*		
But 7 Yards of *Iriſh* Plantation Meaſure		1 Pole, Perch or Rod
40 Poles or Perches		1 Furlong
8 Furlongs		1 Mile

And therefore,

mile 1	*furl.* 8	*poles* 40	*yards* 5½	*feet* 3	*inches* 12	*barly-corns* 3
1	8	320	1760	5280	63360	190080
	1	40	220	660	7920	23760
		1	5½	16½	198	594
			1	3	36	108
				1	12	36
					1	3

And note, that the Yard, as alſo the Ell, is uſually divided into Quarters, and each Quarter into 4 Nails.

Note alſo, that a geometrical Pace is five Feet, and there are 1056 ſuch Paces in an *Eng.* Mile, 1344 in an *Iriſh*.

9. The Parts of the ſuperficial Meaſures of Land are ſuch as are mentioned in the following Table, *viz.*

A *Table of Land-meaſure.*

40 Square Poles or Perches	make	1 Rood, or Quarter of an Acre
4 Roods		1 Acre

By the foregoing Table of *Long-meaſure* you are informed what a Pole or Perch is; and by this, that 40 ſquare Perches is a Rood: Now a ſquare Perch is a Superficies very aptly reſembled by a ſquare Trencher, every Side thereof being a Perch in Length, 40 of them is a Rood, and 4 Roods an Acre; ſo that a Superficies that is 40 Perches long and 4 broad is an Acre of Land, the Acre containing in all 160 ſquare Perches.

10. The leaſt denominative Part of Time is one Second, the greateſt Integer being a Year, from whence is produced this

Table of Time.

60 Seconds	make	1 Minute
60 Minutes		1 Hour
24 Hours		1 Day natural
7 Days		1 Week
4 Weeks		1 Month
13 Months, 1 Day, 6 Hours		1 Year

But the Year is uſually divided into twelve unequal Calendar Months, whoſe Names, and the Number of Days they contain, are as follow, *viz.*

	Days		Days
January	31	*July*	31
February	28	*Auguſt*	31
March	31	*Septemb.*	30
April	30	*October*	31
May	31	*Novemb.*	30
June	30	*Decemb.*	31

So that the Year containeth 365 Days, and 6 Hours; but the 6 Hours are not reckon'd, but only every Leap Year, and then there is a Day added to the latter End of *February*, and then it containeth 29 Days; and that Year is called Leap-year, and containeth 366 Days.

And here note, that as the Hour is divided into 60 Minutes, ſo each Minute is ſub-divided into 60 Seconds, and each Second into 60 Thirds, and each Third into 60 Fourths, *&c.*

The Tropical Year, by the exacteſt Obſervation of the moſt accurate Aſtronomers, is found to be 365 Days, 5 Hours, 49 Minutes, 4 Seconds and 21 Thirds.

CHAP. III.

Of the Species or Kinds of Arithmetick.

THere are ſeveral Species of this Art, and which may be termed either Natural, Artificial, Analytical, Algebraical, Lineal, or Inſtrumental; but what we are now to treat upon relates to the ſingle Parts of Natural Arithmetick, ſo far as concerns Numeration; of which there are alſo four Kinds, *viz. Addition, Subtraction, Multiplication* and *Diviſion.*

CHAP.

CHAP. IV.

Addition of Whole Numbers.

1. *ADDITION* is the Reduction of two or more Numbers, of like Kind, together into one Sum or Total: Or, it is that by which diverſe Numbers are added together, to the end that the Sum or total Value of them all may be diſcovered.

The firſt Number in every *Addition* is called the *Addible Number*; the other, the *Number* or *Numbers* added; and the *Number* invented by the *Addition* is called the *Aggregate* or *Sum*, containing the Value of the *Addition*.

The Collation of the Numbers, is the right placing the Numbers given reſpectively to each Denomination, and the Operation is the artificial adding of the Numbers given together, in order to the finding out of the Aggregate or Sum.

2. In *Addition* place the Numbers given reſpectively the one above the other, in ſuch ſort, that the like Degree, Place, or Denomination, may ſtand in the ſame Series, *viz.* Units under Units, Tens under Tens, Hundreds under Hundreds, *&c.* Pounds under Pounds, Shillings under Shillings, Pence under Pence, *&c.* Yards under Yards, Feet under Feet, *&c.*

3. Having thus placed the Numbers given (as before) and drawn a Line under them, add them together, beginning with the leſſer Denomination, *viz.* at the right Hand; and ſo on, ſubſcribing the Sum under the Line reſpectively: As for Example.

Let there be given 3352, and 213, and 133, to be added together. I ſet the Units in each particular Number under each other, and ſo likewiſe the Tens under the Tens, *&c.* and draw a Line under them, as in the Margent; then I begin at the Place of Units and add them together upwards, ſaying, 3 and 3 are 6, and 2 makes 8, which I ſet under the Line, and under the ſame Figures added together; then I proceed to the next Place, being the Place of Tens, and add them in the ſame Manner as I did in the Place of Units, ſaying, 3 and 1 are 4 and 5 are 9, which likewiſe ſet under the Line reſpectively; then I go on to the Place of Hundreds, and add them up as I did the other, ſaying, 1 and 2 are 3 and 3 are 6, which is alſo ſet under the Line; and laſtly, I go to the Place of Thouſands, and becauſe there are no other Figures to add to the 3, I ſet it under the Line

3352
213
133

3698

Line in its reſpective Place, and ſo the Work is finiſhed; and I find the Sum of the three given Numbers to be 3698.

4. But if the Sum of the Figures of any Series exceedeth ten, or any Number of Tens, ſubſcribe under the ſame the Excels above the Tens, and for every ten carry one, to be added to the next Series towards the left Hand, and ſo go on till you have finiſhed your Addition, always remembering, that how great ſoever the Sum of the Figures of the laſt Series is, it muſt all be ſet down under the Line reſpectively; ſo 3678 being given to be added to 2357, I ſet them down as is before directed, and as you ſee in the Margent, with a Line drawn under them, then I begin and add them together, ſaying, 7 and 8 are 15, which is 5 above 10, wherefore I ſet 5 under the Line, and carry 1 for the 10 to be added to the next Series, ſaying, 1 that I carried and 5 is 6 and 7 are 13, wherefore I ſet down 3, and carry 1 (for the Ten) to the next Series; then I ſay, 1 that I carry'd and 3 are 4 and 6 are 10, now, becauſe it comes to juſt 10 and no more, I ſet 0 under the Line, and carry 1 for the 10 to the next, and ſay, 1 that I carried and 2 are 3 and 3 are 6, which I ſet down in its reſpective Place; thus the Addition is ended, and the total Sum of theſe Numbers is found to be 6035. Several Examples of this Kind follow.

3678	
2357	
6035	

Numbers to be added: 354867, 573846, 785946, 347205

Sum 2061864

Numbers to be added: 748647, 465834, 76483, 648400

Sum 1939364

Numbers to be added: 45346, 38074, 8437, 923, 76

Sum 92856

5. If the Numbers given to be added are contained under divers Denominations, as of *Pounds, Shillings, Pence* and *Farthings*, or of *Tuns, Hundreds, Quarters, Pounds, &c.* then in this Caſe, having diſpoſed of the Numbers of each Denomination under the others of the like Kind, beginning at the leaſt Denomination (minding how many of one Denomination do make an Integer of the next) and having added them up, for every Integer of the next greater Denomination that you find therein contained, bear

an

an Unit in mind to be added to the ſaid next greater Denomination, expreſſing the Exceſs reſpectively under the Line; proceed in this manner until your Addition be finiſhed; the following Example will make the Rule plain to the Learner. Thus theſe following Sums being given to be added, *viz.* 136*l.* 13*s.* 04*d.* 2*qrs.* and 79*l.* 07*s.* 10*d.* 3*qrs.* and 33*l.* 18*s.* 09*d.* 1*qr.* alſo 15*l.* 09*s.* 05*d.* 0*qrs.* The Numbers being diſpoſed according to Order, will ſtand as in the Margent; then I begin at the Denomination of Farthings, and add them up, ſaying, 1 and 3 are 4 and 2 make 6. Now I conſider that 6 Farthings are 1 Penny 2 Farthings; wherefore I ſet down the 2 Farthings in its Place under the Line, and keep 1 in mind to be added to the next Denomination of Pence; then I go on, ſaying, 1 that I carried and 5 are 6 and 9 are 15 and 10 are 25 and 4 are 29; now I conſider that 29 Pence are 2 Shillings and 5 Pence, therefore I ſet down 5 Pence in Order under the Line, and keep in mind for the 2 Shillings to be added to the Shillings; then I go on ſaying, 2 that I carried and 9 are 11 and 18 are 29 and 7 are 36 and 13 are 49; then I conſider that 49 Shillings are 2 Pounds and 9 Shillings, wherefore I ſet the 9 Shillings under the Line, and carry 2 for the 2 Pounds to the next and laſt Denomination of Pounds, and proceed, ſaying, 2 that I carried and 5 makes 7 and 3 are 10 and 9 are 19 and 6 are 25; then I ſet down 5 and carry 2 for the Tens, and proceed, ſaying, 2 that I carry and 1 is 3 and 3 are 6 and 7 are 13 and 3 make 16, and I ſet down 6 and carry 1 for the 10, and go on, ſaying, 1 that I carried and 1 are 2, which I ſet in its Place under the Line, and the Work is finiſhed; and thus I find the Sum of the aforeſaid Numbers to be 265*l.* 9*s.* 5*d.* 2*qrs.*

l.	*s.*	*d.*	*qrs.*
136	13	04	2
79	07	10	3
33	18	09	1
15	09	05	0
265	09	05	2

Here is another Example, in the Operation of which the Learner muſt have an Eye to the Table of *Troy-weight*; the Numbers given are 38 ℔. 7 *oz.* 13 *pwt.* 18 *gr.* and 5 ℔. 10 *oz.* 10 *pwt.* 12 *gr.* and 42 ℔. 8 *oz.* 5 *pwt.* 16 *gr.* And in order to the Addition thereof I place them as you ſee, and proceed to the Operation, ſaying, 16 and 12

are 28 and 18 are 46: now because 24 Grains make 1 Penny-weight, 46 Grains are 1 Penny-weight and 22 Grains, therefore I set down 22, and carry 1 for the Penny-weight, and 5 makes 6 and 10 are 16 and 13 are 29, which is 1 Ounce and 9 Penny-weight; I set down 9 in its Place under the Line, and carry 1 to the Ounces, saying, 1 that I carry and 8 are 9 and 10 are 19, and 7 are 26, and because 26 Ounces make 2 Pounds 2 Ounces, I set down 2 for the Ounces, and carry 2 to the Pounds, going on, 2 that I carry and 2 are 4 and 8 make 12, that is 2 and go 1; then 1 I carry and 4 are 5 and 5 are 10 and 3 are 13, which I set down as in the Margent, and the Work is finished; and I find the Sum of the said Numbers to amount to 132lb 2oz. 9pwt. 22gr. The Way of proving these, or any Sum in this Rule, is shewed immediately after the ensuing Example.

lb	oz.	pwt.	gr.
38	07	13	18
50	10	10	12
42	08	05	16
132	02	09	22

Addition of English Money.

l.	s.	d.	q.
436	13	07	1
184	09	10	3
768	17	04	2
584	11	11	0
1974	12	09	2

l.	s.	d.	qrs.
48	15	11	1
76	10	07	3
18	00	05	3
24	19	09	2
168	06	10	1

Addition of Troy-weight.

lb	oz.	pwt.	gr.
15	07	13	12
18	06	04	20
11	10	16	18
09	04	10	22
19	11	18	04
22	00	00	05
97	05	04	09

lb	oz.	pwt.	gr.
145	09	12	18
726	08	14	10
389	07	06	13
83	10	16	20
130	00	10	12
074	07	15	00
1559	08	16	01

Addition of Apothecaries Weight.

lb	oz.	dr.	sc.	gr.
48	07	1	0	14
74	05	5	2	10
64	10	7	1	16
17	08	1	0	11
34	09	6	1	09
240	05	6	1	00

lb	oz.	dr.	sc.	gr.
60	03	4	0	10
48	10	6	0	14
34	08	2	1	15
18	11	2	2	11
160	07	1	2	15
35	02	5	1	07
358	07	7	0	12

Addition of Averdupois Weight.

Tuns	C.	qrs.	lb
75	13	1	15
48	07	3	21
60	11	1	17
21	07	0	25
12	16	0	11
218	16	0	05

lb	oun.	dr.
36	10	12
22	01	13
11	07	04
15	08	10
20	00	09
105	13	00

Addition of Liquid Measure.

Tuns	pipe	hhd.	gal.
45	1	1	48
15	0	1	17
38	0	0	47
12	1	0	56
21	1	1	18
133	1	1	60

Tuns	hhd.	gal.	pts.
30	3	40	4
12	2	28	6
47	3	60	5
57	3	22	3
17	0	00	0
166	1	26	2

Addition of Dry Measure.

Chal.	qrs.	bush.	pec.
48	3	7	3
13	1	4	0
54	0	6	2
16	3	6	1
40	1	0	1
173	3	0	3

qrs.	bush.	pec.	gal.
17	3	1	1
56	1	3	0
14	5	3	1
40	2	0	1
30	0	3	0
152	5	3	1

Addition of Long Measure.

Yds.	qrs.	nails
35	3	3
14	1	2
74	2	3
38	0	1
30	1	0
15	0	0
208	1	1

Ells	qrs.	nails
56	1	3
13	3	2
48	2	1
50	0	2
74	2	0
17	1	0
200	1	0

Addition of Land Meaſure.

Acre	*Rood*	*Perch*	*Acre*	*Rood*	*Perch*
12	3	18	86	1	36
14	0	24	47	3	24
30	2	19	73	2	28
48	3	30	60	0	07
28	1	38	04	2	08
50	3	26	14	1	14
185	3	35	286	3	37

The Proof of Addition.

6. *Addition* is proved after this Manner: When you have found out the Sum of the Numbers given, then ſeparate the uppermoſt Line from the reſt, with a Stroke or Daſh of the Pen, and then add them all up again as you did before, leaving out the uppermoſt Line; and having ſo done, add the new invented Sum to the uppermoſt Line you ſeparated, and if the Sum of theſe two Lines be equal to the Sum firſt found out, then the Work is performed true, otherwiſe not. As for Example: Let us prove the firſt Example of *Addition of Money*, whoſe Sum we find to be 265*l.* 09*s.* 5*d.* 2*qrs.* and which we prove thus: Having ſeparated the uppermoſt Number from the reſt by a Line, as you ſee in the Margent, then I add the ſame together again, leaving out the ſaid uppermoſt Line, and the Sum thereof I ſet under the firſt Sum, or true Sum, which doth amount to 128*l.* 16*s.* 1*d.* 0*qrs.* then again I add the new Sum to the uppermoſt Line that before was ſeparated from the reſt, and the Sum of theſe two is 265*l.* 09*s.* 5*d.* 2*qrs.* the ſame with the firſt Sum, and therefore I conclude that the Operation was rightly performed.

l.	*s.*	*d.*	*qrs.*
136	13	04	2
79	07	10	3
33	18	09	1
15	09	05	0
265	09	05	2
128	16	01	0
265	09	05	2

7. The mean End of *Addition*, in Queſtions reſolvable thereby, is to know the Sum of ſeveral Debts, Parcels, Integers, *&c.* Some Queſtions may be theſe that follow.

Queſt. 1. There was an old Man whoſe Age was required; to which he replied, I have ſeven Sons, each having two Years between their Birth, and in the 44th Year of my Age my eldeſt Son was born, which is now the Age of the youngeſt. I demand what was the old Man's Age?

Now to reſolve this Queſtion, firſt ſet down the Father's Age at the Birth of his firſt Child, which was 44; then the

the Difference between the oldeſt and the youngeſt, which is 12 Years, and then the Age of the youngeſt, which is 44; and then add them all together, and their Sum is 100, the compleat Age of their Father.

	44
	12
	44
	100

Queſt. 2. A Man lent his Friend, at ſeveral Times, theſe ſeveral Sums, *viz.* at one Time 63*l.* at another Time 50*l.* at another Time 48*l.* at another Time 156*l.* Now I deſire to know how much was lent him in all?

Set the Sums lent under one another, as you ſee in the Margent, and then add them together, and you will find their Sum to amount to 317*l.* which is the Total of all the ſeveral Sums lent, and ſo much is due to the Creditor.

	63
	50
	48
	156
	317

Queſt. 3. There are two Numbers, the leaſt whereof is 40, and their Difference 14. I deſire to know what is the greater Number, and alſo what is the Sum of them both? Firſt ſet down the leaſt, *viz.* 40, and 14 the Difference, and add them together, and their Sum is 54 for the greateſt Number; then I ſet 40 (the leaſt) under 54 (the greateſt) and add them together, and their Sum is 94, equal to the greateſt and leaſt Numbers.

	40
	14
greateſt	54
leaſt	40
Sum	94

CHAP. V.

Of Subtraction *of Whole Numbers.*

SUBTRACTION, is taking of a leſſer Number out of a greater of a like Kind, whereby to find out a third Number, being or declaring the Inequality, Exceſs, or Difference between the Numbers given; or, *Subtraction* is that by which one Number is taken out of another Number given, to the End that the Reſidue or Remainder may be known, which Remainder is alſo called the Reſt, Remainder, or Difference of the Numbers given.

2. The Number out of which *Subtraction* is to be made muſt be greater, or at leaſt equal with the other Number given; the higher Number is called the *Major*, and the lower, *Minor*; and the Operation of *Subtraction* being finiſhed, the Reſt or Remainder is called the *Difference* of the Number given.

3. In *Subtraction*, place the Numbers given reſpectively the one under the other, in ſuch Sort as like Degrees, Places, or Denominations may ſtand in the ſame Series, *viz.* Units under Units, Tens under Tens, Pounds under Pounds.

Pounds, *&c.* Feet under Feet, and Parts under Parts, *&c.* This being done, draw a Line underneath, as in *Addition.*

4. Having placed the Numbers given as is before directed, and drawn a Line under them, ſubtract the lower Number (which in this Caſe muſt always be leſs than the uppermoſt) out of the higher Number, and ſubſcribe the Difference or Remainder reſpectively below the Line, and when the Work is finiſhed, the Number below the Line will give you the Remainder.

As for Example: Let 364521 be given to be ſubtracted from 795836. I ſet the leſſer under the greater, as in the Margent, and draw a Line under them; then beginning at the Right Hand, I ſay, 1 out of 6 and there remains 5, which I ſet in order under the Line; then I proceed to the next, ſaying, 2 from 3 reſts 1, which I note alſo under the Line; and thus I go on till I have finiſhed the Work, and then I find the Remainder or Difference to be 431315.

795836
364521

431315

5. But if it ſo happen (as commonly it doth) that the lowermoſt Number or Figure is greater than the uppermoſt: then in this Caſe add ten to the uppermoſt Number, and ſubtract the ſaid lowermoſt Number from their Sum, and the Remainder place under the Line; and when you go to the next Figure below pay an Unit, by adding it thereto, for the ten you borrowed before, and ſubtract that from the higher Number of Figures, and thus go on till your Subtraction be finiſhed. As for Example: Let 437503 be given, from whence it is required to ſubtract 153827, I diſpoſe of the Numbers as is before directed, and as you ſee in the Margent; then I begin, ſaying, 7 from 3 I cannot, but (adding 10 thereto) I ſay 7 from 13 and there remains 6, which I ſet under the Line in Order; then I proceed to the next Figure, ſaying, 1 that I borrowed and 2 is 3 from 0 I cannot, but 3 from 10 and there remains 7, which I likewiſe ſet down as before; then 1 that I borrowed and 8 is 9 from 5 I cannot, but 9 from 15 and there remains 6; then 1 I borrowed and 3 is 4 from 7 and there remains 3; then 5 from 3 I cannot, but 5 from 13 and there remains 8; then 1 I borrowed and 1 are 2 from 4 and there reſt 2, and thus the Work is finiſh'd: After theſe Numbers are ſubtracted one from another, the Inequality, Remainder, Exceſs or Difference is found to be 283676. Examples for thy farther Experience may be theſe that follow.

437503
153827

283676

From 3469916	From 361577
Take 738642	Take 5864
Reſt 2731274	Reſt 355713

6. I

6. If the Sum or Number to be ſubtracted is of ſeveral Denominations, place the leſſer Sum below the greater, and in the ſame Rank and Order as is ſhewed in *Addition* of the ſame Numbers; then begin at the right Hand, and take the lower Number out of the uppermoſt, if it be leſſer; but if it be bigger than the uppermoſt, then borrow an Unit from the next greater Denomination, and turn it into the Parts of the leſs Denomination, and add thoſe Parts to the uppermoſt, noting the Remainder below the Line; then proceed and pay one to the next Denomination for that which you borrowed before, and proceed in this Order till the Work is finiſhed. An Example of this Rule followeth: Let 375*l.* 13*s.* 7*d.* 1*qr.* be given, from whence let it be required to ſubtract 57*l.* 16*s.* 3*d.* 2*qrs.* In order whereunto I place the Numbers as you ſee in the Margent; and thus I begin at the leaſt Denomination, ſaying, 2 from 1 I cannot, therefore I borrow one Penny from the next Denomination, and turn it into Farthings, which is 4, and adding 4 to 1, which is 5, I ſay, but 2 from 5 and there remains 3, which I put under the Line; then going on I ſay, 1 that I borrowed and 3 is 4 from 7 and there reſts 3; then going on I ſay, 16 from 13 I cannot, but borrowing 1 Pound, and and turning it into 20 Shillings, I add it to 13, and that is (33) wherefore I ſay, 16 from 33 and there remains 17, which I ſet under the Line, and go on, ſaying, 1 that I borrowed and 7 is 8 from 5 I cannot, but 8 from 15 and there remains 7, and the 1 that I borrowed and 5 is 6 from 7 there reſts 1, and 0 from 3 reſts 3, and the Work is done: And I find the Remainder or Difference to be 317*l.* 17*s.* 3*d.* 3*qrs.*

l.	*s.*	*d.*	*qrs*
375	13	07	1
57	16	03	2
317	17	03	3

Another Example of *Troy-weight* may be this, I would ſubtract 17 *lb* 10*oz.* 11*pwt.* 20*gr.* from 24 *lb* 5*oz.* 00*pwt.* 08*gr.* I place the Numbers according to the Rule, and begin ſaying, 20 from 8 I cannot, but I borrow 1 Penny-weight, which is 24 Grains, and add them to 8, and theſe are 32, wherefore I ſay 20 from 32 reſts 12; then 1 that I borrowed and 11 is 12 from 00 I cannot, but 12 from 20 (borrowing an Ounce, which is 20 Penny-weight) and there remains 8;

lb	*oz.*	*pwt.*	*gr.*
24	05	00	08
17	10	11	20
06	06	08	12

then 1 that I borrowed and 10 is 11 from 5 I cannot, but 11 from 17 and there reſts 6; then 1 that I borrowed and 7 is 8 from 4 I cannot, but 8 from 14 and there reſts 6; then 1 that I borrowed and 1 is 2 from 2 and there reſts nothing; ſo that I find the Remainder or Difference to be 6lb 6oz. 8 *pwt.* 12 *gr.*

7. It many times happeneth that you have many Sums or Numbers to be ſubtracted from one Number; as, ſuppoſe a Man ſhould lend his Friend a certain Sum of Money, and his Friend hath paid him part of his Debt at ſeveral Times, then before you can conveniently know what is ſtill owing, you are to add the ſeveral Numbers or Sums of Payment together, and ſubtract their Sum from the whole Debt, and the Remainder is the Sum due to the Creditor: As ſuppoſe *A* lendeth to *B* 564*l.* 16*s.* 10*d.* and *B* hath repaid him 79*l.* 16*s.* 8*d.* at one Time, and 163*l.* 18*s.* 11*d.* at another Time, and 241*l.* 15*s.* 8*d.* another Time; and you would know how the Accompt ſtandeth between them, or what is more due to *A*. In order whereunto I firſt ſet down the Sum which *A* lent, and draw a Line underneath it, then under that Line I ſet the ſeveral Sums of Payment, as you ſee in the Margent; and having brought the ſeveral Sums of Payment into one Total, by the 5th Rule of the 4th Chapter foregoing, I find their Sum amounteth to 485*l.* 11*s.* 3*d.* which I ſubtract from the Sum firſt lent by *A*, by the 6th Rule of this Chapter, and I find the Remainder to be 79*l.* 5*s.* 7*d.* and ſo much is ſtill due to *A*.

	l.	*s.*	*d.*
Lent	564	16	10
Paid at ſeveral Payments.	79	16	08
	163	18	11
	241	15	08
Paid in all	485	11	03
Remains	79	05	07

When the Learner hath good Knowledge of what hath been already delivered in this and the foregoing Chapters, he will with Eaſe underſtand the Manner of working the following Examples.

Subtraction of Whole Numbers.

	l.	*s.*	*d.*	*l.*	*s.*	*d.*	*qrs.*
Borrowed	374	10	03	700	10	11	2
Paid	79	15	11	9	03	11	3
Remains	294	14	04	691	00	11	3
	l.	*s.*	*d.*	*l.*	*s.*	*d.*	*qrs.*
Borrowed	1000	00	00	711	03	00	0
Paid	19	00	06	11	13	00	1
Remains	980	19	06	699	09	11	3

Borrowed

	l.	*s.*	*d.*	*qrs.*
Borrowed	3500	00	00	0
Paid at several Payments	170	10	00	0
	361	13	10	1
	590	03	04	3
	73	04	11	3
Paid in all	1195	12	03	2
Remains due	2304	07	09	1

Subtraction of Troy-weight.

	lb	*oz.*	*pwt.*	*gr.*
Bought	174	00	13	00
Sold	78	04	16	15
Remains	95	07	16	09

	lb	*oz.*	*pwt.*	*gr.*
Bought	470	10	13	00
Sold at several Times	60	00	00	00
	35	10	18	00
	16	07	09	08
	48	04	00	00
	61	11	19	23
	23	00	00	00
Sold in all	245	10	07	07
Remain unsold	225	00	05	17

Subtraction of Apothecaries Weight.

	lb	*oz.*	*dr.*	*sc.*	*gr.*	lb	*oz.*	*dr.*	*sc.*	*gr.*
Bought	12	04	3	0	00	20	00	1	0	07
Sold	8	05	1	1	15	10	00	1	2	12
Rem.	3	11	1	1	05	9	11	7	0	15

Subtraction of Averdupois-weight.

	C.	*qrs.*	lb	*Tun*	*C.*	*qrs.*	lb	*oz.*	*dr.*
Bought	35	0	15	5	07	1	10	10	05
Sold	16	2	20	3	17	1	16	09	13
Remain.	18	1	23	1	09	3	21	00	08

Subtraction of Liquid Measure.

	tu.	*hhd.*	*gal.*	*tu.*	*hhd.*	*gal.*	*pints*
Bought	40	1	30	60	3	42	4
Sold	16	1	40	15	3	46	6
Remain	23	3	53	44	3	58	6

Subtraction of Dry Measure.

	chal.	*qrs.*	*bush.*	*pec.*	*cha.*	*qrs.*	*bush.*	*pecks*
Bought	100	0	0	0	73	2	3	2
Sold	54	1	4	3	46	2	3	3
Remain	45	2	3	1	26	3	7	3

Subtraction of Long Measure.

	yds.	*qrs.*	*nails*	*yds.*	*qrs.*	*nails*
Bought	160	0	0	344	0	1
Sold	64	1	2	177	1	3
Remain	95	2	2	166	2	2

Subtraction of Land Measure.

	acres	*rood*	*perch.*	*acres*	*rood*	*perches*
Bought	140	2	13	600	0	00
Sold	70	3	12	54	0	16
Remain	69	3	01	545	3	24

The Proof of Subtraction.

8. When your Subtraction is ended, if you desire to prove the Work, whether it be true or no, then add the Remainder to the *minor* Number, and if the Aggregate of these two be equal to the *major* Number, then is your Operation true, otherwise false: Thus let us prove the first Example of the fifth Rule of this Chapter, where, after Subtraction is ended, the Numbers stand as in the Margent, the Remainder or Difference being 283676: Now to prove the Work, I add the said Remainder 283676 to the *minor* Number 153827, by the fourth Rule of the foregoing Chapter, and I find the Sum or Aggregate to be 437503, equal to the *major* Number, or Number from whence the lesser is subtracted. See the Work in the Margent.

437503
153827
283676
437503

The Proof of another Example, may be of the first Example of the 6th Rule of this Chapter, where it is required to subtract 57*l.* 16*s.* 3*d.* 2*qrs.* from 375*l.* 13*s.* 7*d.* 1*qr.* and by the Rule I find the Remainder to be 317*l.* 17*s.* 3*d.* 3*qrs.* Now to prove it, I add the said Remainder 317*l.* 17*s.* 3*d.* 3*qrs.* to the *minor* Number 57*l.* 16*s.* 3*d.* 2*qrs.* and their Sum 375*l.* 13*s.* 7*d.* 1*qr.* equal to the *major* Number which proves the Work to be true; but if it had happened to be either more or less than the said *major* Number, then the Operation had been false.

l.	*s.*	*d.*	*qrs.*
375	13	07	1
57	16	03	2
317	17	03	3
375	13	07	1

9. Th

9. The general Effect of Subtraction, is, to find the Difference or Exceſs between two Numbers, and the Reſt when a Payment is made in part of a greater Sum, the Date of Books printed, the Age of any Thing, by knowing the preſent Year, and the Year wherein they were made, created, or built, and ſuch like.

The Queſtions appropriated to this Rule are ſuch as follow.

Queſt. 1. What Difference is there between one Thing of 125 Foot long, and another of 66 Foot long?

To reſolve this Queſtion, I firſt ſet down the *major* or greater Number 125, and under it the *minor* or leſſer Number 66, as is directed in the third Rule of this Chapter, and according to the fourth Rule of the ſame, I ſubtract the *minor* from the *major*, and the Remainder, Exceſs, or Difference I find to be 59. See the Work in the Margent.

	125
	66

	59

Queſt. 2. A Gentleman hath owed a Merchant 365*l.* whereof he hath paid 278*l.* What more doth he owe?

To give an Anſwer to this Queſtion, I firſt ſet down the *major* Number 365*l.* and under it I place 278 the *minor*, and ſubtract the one from the other, whereby I diſcover the Exceſs, Difference or Remainder to be 87; and ſo much is ſtill due to the Creditor, as *per* Margent.

	365
	278

	87

Queſt. 3. An Obligation was written, a Book printed, a Child born, a Church built, or any other Thing made in the Year of our Lord 1572, and now we account the Year of our Lord 1756, the Queſtion is, to know the Age of the ſaid Things, that is, how many Years are paſſed ſince the ſaid Things were made? I ſay, if you ſubtract the leſſer Number 1572, from the greater 1756, the Remainder will be 184, and ſo many Years are paſſed ſince the making of the ſaid Things; as by this Work in the Margent.

	1756
	1572

	184

Queſt. 4. There are three Towns lying in a ſtraight Line, *viz. London*, *Huntingdon* and *York*, now the Diſtance between the fartheſt of theſe Towns, *viz. London* and *York*, is 151 Miles, and from *London* to *Huntingdon* is 49 Miles, I demand how far it is from *Huntingdon* to *York*?

To reſolve this Queſtion, ſubtract 49 the Diſtance between *London* and *Huntingdon*, from 151, the Diſtance between *London* and *York*, and the Remainder is 102, for the true Diſtance between *Huntingdon* and *York*. See the Work in the Margent.

	151
	49

	102

CHAP.

CHAP. VI.

Multiplication of Whole Numbers.

1. *MULTIPLICATION* is performed by two Numbers of like Kind, for the Production of a third, which ſhall have Reaſon to the one as the other hath to the Unit, and in Effect is a moſt brief and artificial *Compound Addition* of many equal Numbers of like Kind into one Sum. Or, *Multiplication* is that by which we multiply two or more Numbers, the one into the other, to the end that their Product may come forth, or be diſcovered.

Or, *Multiplication* is the increaſing of any one Number by any other, ſo often as there are Units in that Number, by which the other is increaſed; or by having two Numbers given, to find a third which ſhall contain one of the Numbers as many Times as there are Units in the other.

2. *Multiplication* hath three Parts. Firſt, the Multiplicand, or Number to be multiplied. Secondly, the Multiplier, or Number given, by which the Multiplicand is to be multiplied. And Thirdly, the Product, or Number produced by the other two, the one being multiplied by the other; as if 8 were given to be multiplied by 4, I ſay 4 times 8 is 32; here 8 is the Multiplicand, and 4 is the Multiplier, and 32 is the Product.

8
4
32

3. *Multiplication* is either *Single*, by one Figure; or *Compound*, that conſiſts of many.

Single Multiplication is ſaid to conſiſt of one Figure, becauſe the Multiplicand and Multiplier conſiſt each of 'em of a Digit, and no more; ſo that the greateſt Product that can ariſe by *Single Multiplication* is 81, being the Square of 9; and *Compound Multiplication* is ſaid to conſiſt of many Figures, becauſe the Multiplicand or Multiplier conſiſts of more Places than one; as if I were to multiply 436 by 6: It is called *Compound*, becauſe the Multiplicand 436 is of more Places than one, *viz.* 3 Places.

4. The Learner ought to have all the Varieties of *Single Multiplication* by Heart, before he can well proceed any farther into this Art, it being of moſt excellent Uſe, and none of the following Rules in *Arithmetick* but what have a principal Dependance thereupon.

MUL-

MULTIPLICATION TABLE.

1	2	3	4	5	6	7	8	9
2	4	6	8	10	12	14	16	18
3	6	9	12	15	18	21	24	27
4	8	12	16	20	24	28	32	36
5	10	15	20	25	30	35	40	45
6	12	15	24	30	36	42	48	54
7	14	21	28	35	42	49	56	63
8	16	24	32	40	48	56	64	72
9	18	27	36	45	54	63	72	81

The Uſe of the precedent Table is this: In the uppermoſt Line or Column you have expreſſed all the Digits from 1 to 9, and likewiſe beginning at 1 and going downwards in the Side Column, you have the ſame; ſo that if you would know the Product of any two ſingle Numbers multiplied by one another, look for one of them (which you pleaſe) in the uppermoſt Column, and for the other in the ſide Column, and running your Eye from each Figure along the reſpective Columns in the common Angle (or Place) where theſe two Columns meet, there is the Product required. As for Example, I would know how much is 8 times 7; firſt, I look for 8 in the uppermoſt Column, and 7 in the ſide Column; then do I caſt my Eye from 8 along the Column downwards from the ſame, and likewiſe from 7 in the ſide Column, I caſt my Eye from thence toward the right Hand, and find it to meet with the firſt Column at 56, ſo that I conclude 56 to be the Product required, *&c.*

5. In *Compound Multiplication*, if the Multiplicand conſiſts of many Places, and the Multiplier of but one Figure, firſt ſet down the Multiplicand, and under it place the Multiplier in the place of Units, and draw a Line underneath them; begin then and multiply the Multiplier into every particular Figure of the Multiplicand, beginning at the Place of Units, and ſo proceed towards the left Hand, ſetting each particular Product under the Line, in order as you proceed; but if any of the Products exceed 10, or any Number of Tens, ſet down the Exceſs, and for every 10 carry an Unit to be added to the next Product, always remembring to ſet down the total Product of the laſt Figure; which Work being finiſhed, the Sum or Number placed under the Line ſhall be the true and total Product required.

As

As for Example, I would multiply 478 by 6; first set down 478, and underneath it 6, in the place of Units, and draw a Line underneath them, as in the Margent, then I begin, saying 6 times 8 is 48. which is 8 above four Tens, therefore I set down 8 (the Exceſs) and bear 4 in mind for the 4 Tens; then I proceed, saying, 6 times 7 is 42, and 4 that I carried is 46, I then set down 6 and carry 4, and go on, saying, 6 times 4 is 24, and 4 that I carried is 28, and becauſe it is the laſt Figure I ſet it all down, and ſo the Work is finiſhed, and the Product is found to be 2868, as was required.

```
 478
   6
 ----
2868
```

6. When in *Compound Multiplication* the Multiplier conſiſteth of divers Places, then begin with the Figure in the Place of Units in the Multiplier, and multiply it into all the Figures in the Multiplicand, placing the Product below the Line, as was directed in the laſt Example; then begin with the Figure of the ſecond Place of the Multiplier, *viz.* the Place of Tens, and multiply it likewiſe into the whole Multiplicand (as you did the firſt Figure) placing its Product under the Product of the firſt Figure; do in the ſame manner by the third, fourth and fifth, *&c.* until you have multiplied all the Figures of the Multiplier particularly into the whole Multiplicand, ſtill placing the Product of each particular Figure under the Product of its precedent Figure; herein obſerving the following Caution.

A Caution. In the placing of the Product of each particular Figure of the Multiplier, you are not to follow the 2d Rule of the 4th Chapter, *viz.* to place Units under Units, and Tens under Tens, *&c.* but to place the Figure or Cypher in the place of Units of the ſecond Line under the ſecond Figure or Place of Tens in the Line above it, and the Figure or Cypher in the Place of Units in the third Line under the place of Tens in the ſecond Line, *&c.* obſerving this Order till you have finiſhed the Work, ſtill placing the firſt Figure of every Line or Product under the ſecond Figure or Place of Tens in that which was above it, and having ſo done, draw a Line under all theſe particular Products and add them together; ſo ſhall the Sum of all theſe Products be the total Product required.

As if it were required to multiply 764 by 27, I ſet 'em down the one under the other, with a Line drawn underneath them, then I begin, ſaying, 7 times 4 is 28, then I ſet down 8 and carry 2; then I ſay, 7 times 6 is 42, and 2 that I carried is 44, that is 4 and go 4; then 7 times 7 is 49, and 4 that I carry is 53, which I ſet down becauſe I have not another

```
  764
   27
 ----
 5348
1528
-----
20628
```

another Figure to multiply; thus have I done with the 7; then I begin with the 2, saying, 2 times 4 is 8, which I set down under (4) the second Figure or place of Tens in the Line above it, as you may see in the Margent; then I proceed, saying, 2 times 6 is 12, that is 2 and carry 1, then 2 times 7 is 14, and 1 that I carry is 15, which I set down, because it is the Product of the last Figure, so that the Product of 764 by 7 is 5348, and by 2 is 1528, which being placed the one under the other, as before directed, as you see in the Margent, and a Line drawn under them, and they added together respectively make 20628, the true Product required, being equal to 27 times 764.

Another Example may be this: Let it be required to multiply 5486 by 465. I dispose of the Multiplicand and Multiplier according to the Rule, and begin multiplying the first Figure of the Multiplier, which is (5) into the whole Multiplicand, and find the Product is 27430; then I proceed, and multiply the second Figure (6) of the Multiplier into the Multiplicand, and find the Product to amount to 32916, which is subscribed under the other Product respectively; then do I multiply the third and last Figure (4) of the Multiplier into the Multiplicand, and the Product is 21944, which is likewise placed under the second Line respectively; then I draw a Line under the said Product, being placed the one under the other (according to Rule) and add them together, and the Sum is 2550990, the true Product sought, being equal to 5486 times 465, or 465 times 5486.

5486	
465	
27430	
32916	
21944	
2550990	

More Examples in this Rule are these following.

430865	6400758
4739	37496
3877785	38404548
1292595	57606822
3016055	25603032
1723460	44805306
2041869235	19202274
	240002821968

Compendium in Multiplication.

7. Altho' the former Rules are sufficient for all Cases in *Multiplication*, yet because in the Work of *Multiplication* many times great Labour may be saved, I shall acquaint the

the Learner with ſome Compendiums in order thereto, *viz.* if the Multiplicand or Multiplier, or both of them, end with Cyphers, then in your multiplying you may neglect the Cyphers, and multiply only the ſignificant Figures, and to the Product of thoſe ſignificant Figures add ſo many Cyphers as the Numbers given to be multiplied did end with; that is, annex them on the right Hand of the ſaid Product, ſo ſhall that give you the true Product required. As if I were to multiply 32000 by 4300, I ſet them down in order to be multiplied, as you ſee in the Margent, but neglecting the Cyphers in both Numbers, I only multiply 32 by 43, and the Product I find to be 1376, to which I annex the 5 Cyphers in the Multiplicand and Multiplier, and then it makes 137600000 for the true Product of 32000 by 4300.

Si numeris propoſitis unus vel uterque adjunctos habeat ad dextram circulos, omiſſis circulis fiat ipſorum numerorum multiplicatio, & facta demum tot inſuper integrorum loci accenſeantur quot ſunt omiſſi circuli in utraque factore. Clavis Mat. *c.* 4. 3.

32000
4300
96
128
137600000

8. If in the Multiplier, Cyphers are placed between ſignificant Figures, then multiply only by the ſignificant Figures neglecting the Cyphers; but here ſpecial Notice is to be taken of the true placing of the firſt Figure after the Neglect of ſuch Cypher or Cyphers, and therefore you muſt obſerve in what Place of the Multiplier the Figure you multiply by ſtandeth, and ſet the firſt Figure of that Product under the ſame Place of the Product of the firſt Figure of your Multiplier: As for Example, let it be required to multiply 371568 by 40007; firſt I multiply the Multiplicand by 7, and the Product is 2600976; then, neglecting the Cyphers, I multiply by 4, and that Product is 1486272; now I conſider that 4 is the fifth Figure in the Multiplier, therefore I place 2 (the firſt Figure of the Product by 4) under the fifth place of the firſt Product by 7, and the reſt in Order, and having added them together, the total Product is found to be 14865320976. Other Examples in this Rule are theſe following.

Si intermedio multiplicantis loco circulus fuerit, ille negligitur. Alſted. *c.* 6. *de Arith.*

371568
40007
2600976
1486272....
14865320976

327586	7864371
6030	20604
9827580	31457484
1965516	47186226
1975343580	15728742
	162037500084

9. If you are to multiply any Number by an Unit with Cyphers, as by 10, 100, 1000, *&c.* then annex ſo many Cyphers before the Multiplicand, and that Number when the Cyphers are annexed is the Product required As if you would multiply 428 by 100, annex two Cyphers to 428, and it is 42800. If it were required to multiply 102 by 10000, annex 4 Cyphers, and it gives 1020000 for the Product required.

The Proof of Multiplication.

10. *Multiplication* is proved by *Diviſion*, and to ſpeak Truth, all other Ways are falſe (according to *Friſius*) and therefore it will be neceſſary in the firſt place to learn *Diviſion*, and by that to prove *Multiplication*. There are ſome other Ways uſed indeed, but on a ſtrict *Examen*, there is not one in a thouſand of their Products right; therefore we omit them.

11. The general Effect of *Multiplication* is contained in the Definition of the ſame, which is to find out a third Number, ſo often containing one of the two given Numbers as the other containeth Units.

The ſecond Effect is, by having the Length and Breadth of any Thing (as a Parallellogram or long Plain) to find the ſuperficial Content of the ſame; and by having the ſuperficial Content of the Baſe, and the Length, to find out the Solidity of any Parallelopipedon, Cylinder, or other ſolid Figure.

The third Effect is, by the Contents, Price, Value, buying, ſelling, Expence, Wages, Exchange, Simple Intereſt, Gain or Loſs of any one Thing, be it Money, Merchandize, *&c.* to find out the Value, Price, Expence, buying, ſelling, Exchange, or Intereſt, of any Number of Things of the like Name, Nature and Kind.

The fourth Effect is not much unlike the other, by the Contents, Value or Price of any one Part of any Thing denominated, to find the Contents, Value or Price of the whole Thing, all the Parts into which the Whole is divided, multiplying the Price of one of thoſe Parts.

The fifth Effect is, to aid, to compound and to make other Rules, as chiefly, the *Rule of Proportion*, called the *Golden Rule*, or *Rule of Three*; alſo by it Things of one Denomination are reduced to another. If

If you multiply any Number of Integers, by the Price of the Integer, the Product will diſcover the Price of the Quantity, or Number of Integers given.

In a rectangular Solid, if you multiply the Breadth of the Baſe by the Depth, and that Product by the Length, the laſt Product will diſcover the Solidity or Content of the ſame Solid.

Some Queſtions proper to this Rule, may be theſe following.

Queſt. 1. What is the Contents of a ſquare Piece of Ground, whoſe Length is 28 Perches and Breadth 13?

Anſwer, 364 ſquare Perches; for multiplying 28 the Length, by 13 the Breadth, the Product is ſo much.

Queſt. 2. There is a ſquare Battle, whoſe Flank is 47 Men, and the Files 19 deep, what Number of Men doth that Battle contain? *Facit* 893; for multiplying 47 by 19 the Product is 893.

Queſt. 3. If any one Thing coſt 4 Shillings, what ſhall 9 ſuch Things coſt? *Anſw.* 36 Shillings; for multiplying 4 by 9 the Product is 36.

Queſt. 4. If a Piece of Money or Merchandize be worth or coſt 17 Shillings, what ſhall 19 ſuch Pieces of Money or Merchandize coſt? *Facit* 323 Shillings, which is equal to 16*l.* 3*s.*

Queſt. 5. If a Soldier or Servant get or ſpend 14*s.* *per* Month, what is the Wages or Charges of 49 Soldiers or Servants for the ſame Time? Multiply 49 by 14, the Product is 686*s.* or 34*l.* 6*s.* for the Anſwer.

Queſt. 6. If in a Day there are 24 Hours, how many Hours are there in a Year, accounting 365 Days to conſtitute the Year? *Facit* 8760 Hours, to which if you add the 6 Hours over and above 365 Days, as there is in a Year, then it will be 8766 Hours; now if you multiply this 8766 by 60, the Number of Minutes in an Hour, it will produce 525960, the Number of Minutes in a Year.

CHAP. VII.

Diviſion of Whole Numbers.

1. DIVISION is the ſeparating or parting of any Number or Quantity given, into any Part aſſigned; or to find how often one Number is contained in another; or from any two Numbers given, to find a third that ſhall conſiſt of ſo many Units, as the one of thoſe two Numbers given is comprehended or contained in the other.

2. *Diviſion* hath three Parts of Numbers remarkable, *viz. firſt*, the Dividend; *2dly*, the Diviſor, *3dly*, the Quotient

tient. The Dividend is the Number given to be parted or divided. The Diviſor is the Number given by which the Dividend is divided, or it is the Number which ſheweth how many Parts the Dividend is to be divided into, and the Quotient is the Number produced by the Diviſion of the two given Numbers the one by the other.

So 12 being given to be divided by 3, or into three equal Parts, the Quotient will be 4; for 3 is contained in 12 four times, where 12 is the Dividend, and 3 is the Diviſor, and 4 is the Quotient.

3. In *Diviſion*, ſet down your Dividend, and draw a crooked Line at each End of it, and before the Line at the left Hand place the Diviſor, and behind that on the right Hand place the Figures of the Quotient, as in the Margent, where it is required to divide 12 by 3; 3)12 (4 firſt, I ſet down 12 the Dividend, and on each Side of it I do draw a crooked Line, and before that on the left Hand do I place 3 the Diviſor, then do I ſeek how often 3 is contained in 12, and becauſe I find it four times, I put 4 behind the crooked Line, on the right Hand of the Dividend, denoting the Quotient.

4. But if, when the Diviſor is a ſingle Figure, the Dividend conſiſteth of two or more Places, then having placed them for the Work (as before directed) put a Point under the firſt Figure of the left Hand of the Dividend, provided it be bigger than (or equal to) the Diviſor: but if it be leſſer than the Diviſor, then put a Point under the ſecond Figure from the left Hand of the Dividend, which Figures, as far as the Point goeth from the left Hand, are to be reckon'd by themſelves, as if they had no Dependance upon the other part of the Dividend, and for Diſtinction ſake may be called the Dividual; then ask how often the Diviſor is contained in the Dividual, placing the Anſwer in the Quotient, then multiply the Diviſor by the Figure that you placed in the Quotient, and ſet the Product thereof under your Dividual, then draw a Line under the Product, and ſubtract the ſaid Product from the Dividual, placing the Remainder under the ſaid Line; then put a Point under the next Figure in the Dividend, on the right Hand of that to which you put the Point before, and draw it down, placing it on the right Hand of the Remainder which you found by *Subtraction*, which Remainder, with the ſaid Figure annexed before it, ſhall be a new Dividual; then ſeek again how often the Diviſor is contained in this new Dividual, and put the Anſwer in the Quotient, on the right Hand of the Figure which you put there before: then multiply the Diviſor by the laſt Figure that you put in the Quotient, and ſubſcribe the

the Product under the Dividual and make Subtraction, and to the Remainder draw down the next Figure from the grand Dividend (having firſt put a Point under it) and put it on the right Hand of the Remainder for a new Dividual, as before; and proceed thus till the Work is finiſhed.

Obſerving this general Rule in all Kinds of *Diviſion*; firſt, to ſeek how often the Diviſor is contained in the Dividual, then (having put the Anſwer in the Quotient) multiply the Diviſor thereby, and ſubtract the Product from the Dividual: An Example or two will make the Rule plain. Let it be required to divide 2184 by 6. I diſpoſe of the Numbers given as is before directed, and as you ſee in the Margent; in order to the Work, then becauſe 6 the Diviſor is more than 2 the firſt Figure of the Dividend, I put a Point under 1 the ſecond Figure, which makes 21 for the Dividual; then do I ask how often 6 the Diviſor is contained in 21, and becauſe I cannot have it more than 3 times, I put 3 in the Quotient, and thereby do I multiply the Diviſor (6) and the Product is 18, which I ſet in order under the Dividual, and ſubtract it therefrom, and the Remainder (3) I place in order under the Line, as you ſee in the Margent.

```
6) 2184 (3
   .
  18
  ---
   3
```

```
6) 2184 (36
   ..
  18
  ---
  38
  36
  ---
```

Then do I make a Point under the next Figure of the Dividend, being 8, and draw it down, placing it before the Remainder 3, ſo have I 38 for a new Dividual; then do I ſeek how often 6 is contained in 38, and becauſe I can't have it more than 6 times, I put 6 in the Quotient, and thereby do I multiply the Diviſor 6, and the Product (36) I put under the Dividual (38) and ſubtract it therefrom, and the Remainder (2) I put under the Line, as you ſee in the Margent.

Then do I put a Point under the next (and laſt) Figure of the Dividend (being 4) and draw it down to the Remainder 2, and putting it on the right Hand thereof, it maketh 24 for a new Dividual; then I ask how often 6 is contained in 24, and the Anſwer is 4, which I put in the Quotient, and multiply the Diviſor (6) thereby, and the Product (24) I put under the Dividual (24) and ſubtract it therefrom, and the Remainder is (0); and thus the Work is finiſhed, and I find the Quotient to be 364, that is, 6 is contained in 2184 juſt 364 times, or 2184 being divided into 6 equal Parts, 364 is one of thoſe Parts. Again,

```
6)2184(364
   ...
  18
  ---
  38
  36
  ---
  24
  24
  ---
  (0)
```

Again, If it were required to divide 2646 by 7, or into 7 equal Parts, the Quotient will be found to be 378, as by the following Operation appeareth.

```
7)2646(378
...
 21
 ---
  54
  49
  --
   56
   56
   --
   00
```

So if it be required to divide 946 by 8, the Quotient will be found to be 118, and 2 remaining after Diviſion is ended. The Work followeth:

```
8)946(118
...
 8
 -
 14
  8
  -
  66
  64
  --
  (2)
```

Many times the Dividend cannot exactly be divided by the Diviſor, but ſomething will remain, as in the laſt Example, where 946 was given to be divided by 8, the Quotient was 118, and there remained 2 after the Diviſion was ended: Now what is to be done in this Caſe with the Remainder, the Learner ſhall be taught when we come to treat of the reducing (or Reduction) of Fractions.

And here note, That if, after your Diviſion is ended, any Thing do remain, it muſt be leſſer than your Diviſor, for otherwiſe your Work is not rightly performed.

Other Examples are ſuch as follow.

```
8)73464(9183
....
 72
 --
  14
   8
   -
   66
   64
   --
    24
    24
    --
    (0)
```

```
9)13758(1528
....
 9
 -
 47
 45
 --
  25
  18
  --
   78
   72
   --
   (6)
```

But

5. But if the Diviſor conſiſteth of more Places than one, then chuſe ſo many Figures from the left Side of the Dividend for a Dividual as there are Figures in the Diviſor, and put a Point under the ſartheſt Figure of that Dividual to the right Hand, and ſeek how often the firſt Figure on the left Side of the Diviſor is contained in the firſt Figure on the left Side of the Dividual, and place the Anſwer in the Quotient, and thereby multiply your Diviſor, placing your Product under your Dividual, and ſubtract it therefrom, placing the Remainder below the Line; then put a Point under the next Figure in the Dividend, and draw it down to the ſaid Remainder, and annex it on the right Side thereof, which makes a new Dividual, and proceed as before, till the Work is finiſhed.

And if it ſo happen, that after you have choſen your firſt Dividual, (as is before directed) you find it to be leſſer than the Diviſor, then put a Point under the Figure more near to the right Hand, and ſeek how often the firſt Figure on the left Side of the Diviſor is contained in the two firſt Figures on the left Side of the Dividual, and place the Anſwer in the Quotient, by which multiply the Diviſor, and place the Product thereof in order, under the Dividual, and ſubtract it therefrom, and proceed as before

Always remembering that in all Caſes of *Diviſion*, if after you have multiplied your Diviſor by the Figure laſt placed in the Quotient, if the Product be greater than the Dividual, then you muſt cancel that Figure in the Quotient, and inſtead thereof put a Figure leſſer by an Unit (or one) and multiply the Diviſor thereby, and if ſtill the Product be greater than the Dividual, make the Figure in the Quotient yet leſſer by an Unit, and thus do until your Product be leſſer than the Dividual, or at the moſt equal thereto, and then make Subtraction, *&c.*

So if you would divide 9464 by 24, the Quotient will be found to be 394; I firſt put down the given Number, as is before directed in the 3d Rule. Now becauſe my Diviſor conſiſteth of two Figures, I therefore put a Point under the ſecond Figure from the left Hand of my Dividend, which here is 4, wherefore I ſeek how often 2 the firſt Figure on the left Side of the Diviſor) is contained in 9, the like firſt in the Dividual, the Anſwer is 4, which I put in the Quotient, and thereby multiply all the Diviſor, and find the Product to be 96, which is greater than the Dividual 94, wherefore I cancel the 4 in the Quotient, and inſtead thereof I put 3 (an

```
24)9464(39
   72
   226
   216
   10
```

(an Unit leſſer) and by it multiply the Diviſor 24, and the Product is 72, which I ſubtract from 94 the Dividual, and the Remainder is 22; then do I make a Point under the next Figure 6 in the Dividend, and draw it down and place it on the right Side of the Remainder 22, and it makes 226 for a new Dividual; now becauſe the Dividual 226 conſiſteth of a Figure more than the Diviſor, therefore I ſeek how often 2 (the firſt Figure of the Diviſor) is contained in 22, the two firſt Figures of the Dividual, and I ſay 9 times, wherefore I put 9 in the Quotient, and thereby multiply the Diviſor 24, the Product (216) I place under the Dividual 226, and ſubtract it, and there remaineth 10.

```
24)9464(39
...
 72
---
 220
 216
---
  10
```

Then I go on and make a Point under the next and laſt Figure (4) in the Dividend, and draw it down to the Remainder 10, and it makes 104 for a new Dividual, which is alſo a Figure more than the Diviſor, and therefore I ſeek how often 2 is contained in 10, I anſwer 5 times; but multiplying my Diviſor by 5, the Product is 120, which is greater than the Dividual, and therefore I make it but 4, and by it multiply the Diviſor, and the Product is 96, which being placed under, and ſubtracted from the Dividual, there remaineth 8; and thus the whole Work of this Diviſion is ended, and I find that 9464 being divided by 24, or into 24 equal Parts, is found to be 394, as was ſaid before, and the Remainder is 8, as you ſee in the Work following.

```
24)9464(394
...
 72
---
 226
 216
---
 104
  96
---
 (8)
```

Another Example may be this: Let there be required the Quotient of 1183653 divided by 385: Firſt I diſpoſe of the Numbers in order to their dividing, and becauſe 118, the three firſt Figures of the Dividend, is leſſer than the Diviſor 385, I therefore make a Point under the fourth Figure, which is 3, and ſeek how often 3 (the firſt Figure of the Diviſor) is contained in 11; the Anſwer is 3, which I put in the Quotient, and thereby multiply the Diviſor 385, and the Product is 1155, which

```
385)1183653(3
...
 1155
-----
  28
```

which I ſubtract from the Dividual 1183, and there remains 28: Then, as before, I draw down the next Figure, which is 6, and place it before the Remainder 28, ſo have I 286 for a new Dividual, and becauſe it hath no more Figures than the Diviſor, I ſeek how often 3 (the firſt Figure of the Diviſor) is contained in 2 (the firſt Figure of the Dividual) and the Anſwer is 0; for a greater Number cannot be contained in a leſſer; wherefore I put 0 in the Quotient, and thereby, according to the fifth Rule, I ſhould multiply the Diviſor, but if I do the Product will be 0, and 0 ſubtracted from the Dividual 286, the Remainder is the ſame; wherefore I draw down the next Figure (5) from the Dividend, and put it before the ſaid Remainder 286, ſo have I 2865 for a new Dividual; and becauſe it conſiſteth of four Places, *viz.* a Place more than the Diviſor, I ſeek how often 3, the firſt Figure of the Diviſor, is contained in 28, the two firſt of the Dividual, and I ſay there is 9 times 3 in 28; but multiplying my whole Diviſor (385) thereby, I find the Product to be 3465, which is greater than the Dividual 2865; wherefore I chuſe 8, which is leſſer by an Unit than 9, and thereby I multiply my Diviſor 385, and the Product is 3080, which ſtill is greater than the ſaid Dividual: wherefore I chuſe another Number yet an Unit leſſer, *viz.* 7, and having multiplied my Diviſor thereby, the Product is 2695, which is leſſer than the Dividual 2865, wherefore I put 7 in the Quotient, and ſubtract 2695 from the Dividual 2865, and there remains 170; then I draw down the laſt Figure (3) in the Dividend, and place it before the ſaid Remainder 170, and it makes 1703 for a new Dividual; then, for the Reaſon aboveſaid, I ſeek how often 3 is contained in 17, the Anſwer is 5, but multiplying the Diviſor thereby, the Product is 1925, greater than the Dividual, wherefore I ſay it will bear 4 (an Unit leſſer) and by it I multiply the Diviſor 385 and the Product is 1540, which is leſſer than the Dividual, and therefore I put 4 in the Quotient, and ſubtract the ſaid Product from the Dividual, and there remains 163; and thus the Work is finiſh'd, and I find that 1183653 being divided by 385, or into 385 equal Shares or Parts, the Quotient, or one of thoſe Parts, is 3074, and beſides there is 163 remaining.

```
385)1183653(30
    1155
    ----
     286
```

```
385)1183653(307
    1155
    ----
     2865
     2695
     ----
      170
```

```
385)1183653(3074
    1155
    ----
     2865
     2695
     ----
      1703
      1540
      ----
      (163)
```

And

And thus the Learner being well verſed in the Method of the foregoing Examples, he may be ſufficiently qualified for the dividing of any greater Sum or Number into as many Parts as he pleaſeth; that is, he may underſtand the Method of dividing by a Diviſor which conſiſteth of 4, or 5, or 6, or any greater Number of Places, the Method being the ſame with the foregoing Examples in every reſpect.

Other Examples in Diviſion.

27986)835684790(29860
....
55972
275964
251874
240907
223888
170199
167916
Remain (22830)

196374(47398601 8)2413
....
392748
812380
785496
268841
196374
724678
589122
Remain (135556)

So if you divide 47386473 by 58736, you will find the Quotient to be 806, and 45257 will remain after the Work is ended.

In like manner: if you would divide 3846739204 by 483064, the Quotient will be 7963, and the Remainder after Diviſion will be 100572.

Compendiums in Diviſion.

1. IF any given Number be to be divided by another Number that hath Cyphers annexed on the right Side thereof, (omitting the Cyphers) you may cut off ſo many Figures from the right Hand of the Dividend, as there are Cyphers before the Diviſor, and let the remaining Numbers in the Dividend be divided by the remaining Numbers

of the Diviſor, obſerving this Caution, That if after your Diviſion is ended any thing remain, you are to annex thereto the Number or Numbers that were cut off from the Dividend, and ſuch new found Number ſhall be the Remainder. (See Mr. *Oughtred's Clavis Mathematica*, cap. 5. 3.) As for Example, Let it be required to divide 46658 by 400; now becauſe there are two Cyphers before the Diviſor, I cut off as many Figures from before the Dividend, *viz.* 58, ſo that then there will remain only 466 to be divided by 4, and the Quotient will be 116, and there will remain 2, to which I annex the two Figures (58) which were cut off from the Dividend, and it makes 258 for the true Remainder; ſo that I conclude 46658 being divided by 400, the Quotient will be 116; and 258 remain after the Work is ended, as by the Work in the Margent.

400) 466|58 (116
4
6
4
26
24
(258)

2. And hence it followeth, that if the Diviſor be 1, or an Unit with Cyphers annexed, you may cut off ſo many Figures from before the Dividend as there are Cyphers in the Diviſor, and then the Figure or Figures that are on the left Hand will be the Quotient, and thoſe that are on the right Hand will be the Remainder after the Diviſion is ended. (*Vid. Gem. Friſ. Arith par.* 1.) As thus; if 45783 were to be divided by 10, I cut off the laſt Figure (3) with a Daſh, thus, 4578|3, and the Work is done, and the Quotient is 4578, the Number on the left Hand of the Daſh, and the Remainder is 3, on the right Hand. In like manner, if the ſame Number 45783 were to be divided by 100, I cut off two Figures from the End, thus, 457|83 and the Quotient is 457, and the Remainder is 83. And if I am to divide the ſame by 1000, I cut off three Figures from the End, thus, 45|783, and the Quotient is 45, and 783 is the Remainder, *&c.*

6. The general Effect of *Diviſion* is contained in the Definition of the ſame, that is by having two unequal Numbers given, to find a third Number in ſuch Proportion to the Dividend, as the Diviſor hath to Unit or 1: It alſo diſcovers what Reaſon or Proportion there is between Numbers, ſo if you divide 12 by 4, it quotes 3, which ſhews the Reaſon or Proportion of 4 to 12 is triple.

The ſecond Effect is, by the ſuperficial Meaſure or Content, and the Length of any Oblong, Rectangular, Parallelogram, or ſquare Plane known, to find out the Breadth thereby;

thereby; or contrarywiſe, by having the Superficies and Breadth of the ſaid Figure, to find out the Length thereof. Alſo by having the Solidity and Length of a Solid, to find the Superficies of the Baſe, *& contra*

The third Effect is, by the Contents, Reaſon, Price, Value, Buying, Selling, Expences, Wages, Exchange, Intereſt, Profit, or Loſs of any Number of Things, be it Money, Merchandize, or what elſe; to find out the Contents, Reaſon, Price, Value, Buying, Selling, Expence, Wages, Exchange, Intereſt, Profit or Loſs of any one Thing of the like Kind.

The fourth Effect is, to aid, to compoſe and to make other Rules, but principally the Rule of Proportion, called the *Golden Rule*, or *Rule of Three*, and the Reduction of Monies, Weights and Meaſures of one Denomination into another; by it alſo Fractions are abbreviated, by finding a common Meaſure unto the Numerator and Denominator, thereby diſcovering commenſurable Numbers.

If you divide the Value of any certain Quantity by the ſame Quantity, the Quotient diſcovers the Rate or Value of the Integer; as if 8 Yards of Cloth coſt 96 Shillings, if you divide (96) the Value or Price of the given Quantity, by (8) the ſame Quantity, the Quotient will be 12, which is the Price or Value of one of thoſe Yards.

If you divide the Value or Price of any unknown Quantity by the Value of the Integer, it gives you in the Quotient that unknown Quantity, whoſe Price is thus divided; as if 12 Shillings were the Value of a Yard, I would know how many Yards are worth 96 Shillings: Here if you divide 96, the Price or Value of the unknown Quantity, by 12, the Rate of the Integer, 1 or 1 Yard, the Quotient will be 8, which is the Number of Yards worth 96*s*.

Some Queſtions anſwer'd by Diviſion may be theſe following.

Queſt. 1. If 22 Things coſt 66 Shillings, what will 1 ſuch Thing coſt? *Facit* 3 Shillings; for if you divide 66 by 22, the Quotient is 3 for the Anſwer. So if 26 Yards or Ells of any Thing be bought or ſold for 78*l.* how much will one Yard or Ell be bought or ſold for? *Facit* 3*l.* for if you divide 78 by 26 Yards, the Quotient will be 3*l.* the Price of the Integer.

Queſt. 2. If the Expence, Charges or Wages of 7 Years amount to 868*l.* what is the Expence, Charges or Wages of one Year? *Facit* 124*l.* for if you divide 868, the Wages of 7 Years, by 7, the Number of Years, the Quotient will be 124*l.* for the Anſwer. See the Work.

7) 868 (124
..
7
16
14
28
28
(0)

Queſt. 3. If the Content of one ſuperficial Foot be 144 Inches, and the Breadth of a Board be 9 Inches, how many Inches of that Board in Length will make ſuch a Foot? *Facit* 16 Inches; for by dividing 144, the Number of ſquare Inches in a ſquare Foot, by 2, the Inches in the Breadth of the Board, the Quotient is 16 for the Number of Inches in the Length of that Board to make a ſuperficial Foot.

9) 144 (16 *Inches*
..
9
54
54
(0)

Queſt. 4. If the Content of an Acre of Ground be 160 ſquare Perches, and the Length of a Furlong (propounded) be 80 Perches, how many Perches will there go in Breadth to make an Acre? *Facit* 2 Perches; for if you divide 160, the Number of Perches in an Acre, by 80, the Length of the Furlong in Perches, the Quotient is 2 Perches, and ſo many in Breadth of that Furlong will make an Acre.

80) 160 (2 Perches.
..
160
(0)

Queſt. 5. If there be 893 Men to be made up into a Battle, the Front conſiſting of 47 Men, what Number muſt there be in the File? *Facit* 19 deep in the File; for if you divide 893, the Number of Men, by 47, the Number in the Front, the Quotient will be 19 in Depth of the File. The Work followeth.

47) 893 (19 deep in File.
..
47
423
423
(0)

Queſt.

l.	*d.*
148	13 ½
240	12
	9
5920	6
296	4
35520 Pence in 148 *l.*	Sum 44 ½
2	2
71040 Half-pence	89 Halfp.

89) 71040 (798 Pieces of each Sort

623

874
801

730
712

Rem. (18) Half-pence.

The Truth of the two foregoing Operations will thus be proved, *viz.* multiply the Anſwer by the Parts or Pieces into which the given Number was reduced, and having added the ſeveral Products together, if their Sum be equal to the given Number the Anſwer is right, otherwiſe not; ſo the Anſwer to the 11th Queſtion was 87720, which is proved as followeth, *viz.*

		l.
87720	Six-pences make	2193
	Four-pences make	1462
	Two-pences make	731
	The total Sum of them	4386

which was the Sum given to be changed.

The Anſwer to the 12th Queſtion was 798, and 18 Half-pence remained after the Work was ended; now the Truth of the Work may be proved as the former, *viz.*

		l.	*s.*	*d.*
798	Pieces of 13*d.* ½ make	44	17	9
	Pieces of 12 make	39	18	0
	Pieces of 9 make	29	18	6
	Pieces of 6 make	19	19	0
	Pieces of 4 make	13	06	0
and 18 Half-pence, or 9*d.* remain		00	00	9
	The total Sum of them	148	00	0

which total Sum is equal to the Number that was first given to be changed, and therefore the Operation was rightly performed.

Reduction of Troy-weight.

We come now to give the Learner a few Examples in Troy-weight; in working whereof he must be mindful of the Table of Troy-weight delivered in the second Chapter of this Book.

Quest. 13. In 482lb. 7 *oz.* 13 *pwt.* 21 *gr.* how many Grains?

lb	*oz.*	*pwt.*	*gr.*
482	7	13	21
12			
971			
482			
5791 Ounces			
20			
115833 Penny-weight			
24			
463333			
231668			
Fac. 2780013 Grains			

Multiply by 12, by 20, and by 24, taking in the Figures standing in the several Denominations; according to the Direction given in the seventh Rule of this Chapter, and you will find the Product to be 2780013 Grains, which is the Number required, or Answer to the Question. See the whole Work, as in the Margent.

Quest. 14. In 2780013 Grains, I demand how many Pounds, Ounces, Penny-weights and Grains?

This is but the foregoing Question inverted, and is resolved by dividing by 24, by 20, and by 12, and the Answer is 482lb 7 *oz.* 13 *pwt.* 21 *gr.*

24

```
                  2|0        12
24)2780013(11583|3(5791(482 lb
   ....     ....    ..
   24       10      48
   ---      ---     ---
    38       15      99
    24       14      96
   ---      ---     ---
   140       18      31
   120       18      24
   ---      ---     ---
   200        3 Rem. 7 Ounces
   192        2
   ---      ---
     81 Rem. 13 Penny-weight
     72
     --
     93                    lb  oz.  pwt.  gr.
     72          Facit    482   7   13   21
     --
Remains 21 Grains.
```

Queſt. 15. A Merchant ſent to a Goldſmith 16 Ingots of Silver, each containing in Weight 2 lb 4 *oz.* and ordered it to be made into Bowls of 2 lb 8 *oz. per* Bowl, and Tankards of 1 lb 6 *oz. per* Piece, and Salts of 10 *oz.* 10 *pwt. per* Salt, and Spoons of 1 *oz.* 18 *pwt. per* Spoon, and of each an equal Number; I deſire to know how many of each ſort he muſt make?

This Queſtion is of the ſame Nature with the 11th and 12th Queſtions foregoing, and may be anſwered after the ſame Method, *viz.* Firſt, add the Weight of the ſeveral Veſſels into which the Silver is to be made into one Sum, and reduce it to one Denomination, and they make 1248 Penny-weights; then reduce the Weight of the Ingot into the ſame Denomination, *viz.* Penny-weights, and it makes 560 Penny-weights, and multiply them by the Number of Ingots, *viz.* 16, and the Product will give you the Weight of the 16 Ingots, *viz.* 8960; then divide the Product by the Weight of the Veſſels, *viz.* 1248, and the Quotient giveth you the Anſwer to the Queſtion, *viz.* 7, and 224 *pwt.* remaineth over and above.

lb	oz.
2	4
12	
28	
20	
560	Penny-weights
16	Ingots
3360	
560	
1248)8960(7	Veſſels of each
8736	
Rem. 224	Penny-weights

	lb	oz.	pwt.
	2	08	00
	1	06	00
	0	10	10
	0	01	18
Sum	5	02	08
	12		
	62		
	20		
	1248		

The Proof of the Work is as followeth, viz.

						lb	oz.	pwt.
7	Bowls	of 2	08	00 *per* Bowl,	is	18	08	00
	Tankards	of 1	06	00 *per* Tank.	is	10	06	00
	Salts	of 0	10	10 *per* Salt,	is	06	01	10
	Spoons	of 0	01	18 *per* Spoon,	is	01	01	06
	224 Penny-weight remaining					00	11	04
						37	04	00

So that you ſee the Sum of the Weight of each Veſſel, together with the Remainder, is 37 lb 4 oz. which is equal to the Weight of the 16 Ingots delivered; for if 37 lb 4 oz. be reduced to Penny-weights, it makes 8960.

Reduction of Averdupois-weight.

In reducing Averdupois-weights, the Learner muſt have Recourſe to the Table of Averdupois-weight, delivered in the ſecond Chapter.

Queſt.

Queſt. 16. In 47 *C.* 1 *qr.* 20 lb how many Ounces? Multiply by 4, by 28, and 16, and the laſt Product will be the Anſwer, *viz.* 84992 Ounces. See the Margent.

C.	*qr.*	lb
47	1	20
4		
189 Quarters		
28		
1512		
380		
5312		
16		
31872		
5312		

Facit 84992 Ounces

Queſt. 17. In 84992 Ounces, I demand how many *C. qrs.* lb and *oz.*

This is the foregoing Queſtion inverted, and will be reſolved, if you divide by 16, by 28, and by 4, and the Anſwer is 47 *C.* 1 *qr.* 20 lb equal to the given Number in the foregoing Queſtion.

	28)	4)	*C*	*qr.*	lb	*oz.*
16) 84992 (	5312 (	189 (	47	1	20	00
80	28	16				
49	251	29				
48	224	28				
19	272	(1) *qr.*				
16	252					
32	(20) lb					
32						
(0)						

Reduction of Liquid Measure.

Queſt. 18. In 45 Tuns of Wine, how many Gallons? Multiply by 4, and by 63, the Product is 11340 Gallons for the Anſwer.

45
4
180
63
540
1080
Facit 11340 Gallons

Queſt. 19. In 34 Rundlets of Wine, each containing 18 Gallons, I demand how many Hogſheads?

Firſt, I find how many Gallons are in the 34 Rundlets, which you may do if you multiply 34 by 18, the Content of a Rundlet, and the Product is 612 Gallons, which you may reduce into Hogſheads, if you divide them by 63, and the Quote will be 9 Hogſheads and 45 Gallons. See the Work.

34
18
272
34
63)612(9 hhds.
567
Facit 9 hhds, 45 Gal.
Rem. 45 Gallons

Queſt. 20. In 12 Tun, how many Rundlets of 14 Gallons *per* Rundlet.

Reduce your Tuns into Gallons, and divide them by 14, the Gallons in a Rundlet, and the Quotient 216, is your Anſwer. See the Work following.

12
4
48
63
144
288
14)3024(216 Rundlets
28
22
14
84
84
(0) *Facit* 216 Rundlets.

Reduction

Reduction of Long Measure.

Queſt. 21. I demand how many Furlongs, Poles, Inches and Barly-corns will reach from *London* to *York*, it being accounted 151 Miles?

151 Miles
8 Furlongs in a Mile
1208 Furlongs
40 Poles in a Furlong
48320 Poles
11 Half-yards in a Pole
48320
48320
531520 Half-yards
18 Inches in half a Yard
4252160
531520
9567360 Inches
3 Barly-corns in one Inch
Facit 28702080 Barly-corns in 151 *Engliſh* Miles.

Queſt. 22. The Circumference of the Earth (as all other Circles are) is divided into 360 Degrees, and each Degree into 60 Minutes, which (upon the Superficies of the Earth) are equal to 60 Miles; now I demand how many Miles, Furlongs, Perches, Yards, Feet and Barly-corns will reach round the Globe of the Earth?

360 Degrees
60 Minutes or Miles in a Degree
21600 Miles about the Earth
8 Furlongs in a Mile
172800 Furlongs about the Earth
40 Perches in a Furlong
6912000 Poles or Perches about the Earth
11 Half-yards in a Perch
6912000
6912000
2)76032000 Half-yards upon the Earth
)38016000 Yards, *viz.* the Half-yards divided by 2
3
114048000 Feet about the Earth
12 Inches in a Foot
228096000
114048000
1368576000 Inches about the Earth
3 Barly-corns in an Inch
4105728000 Barly-corns

And ſo many will reach round the World, the whole being about 21600 Miles; ſo that if any Perſon were to go round, and go 15 Miles every Day, he would go the whole Circumference in 1440 Days, which is 3 Years, 11 Months, and 15 Days.

Reduction of Time.

Queſt: 23. In 28 Years, 24 Weeks, 4 Days, 16 Hours, 30 Minutes, how many Minutes?

Years Weeks Days Hours Min.
28 24 4 16 30
52 Weeks in a Year.

60
142

1480 Weeks
7

10364 Days
24

41462
20729

248752 Hours
60

14925150

Note, That in reſolving the laſt Queſtion after the Method expreſſed, there is loſt in every Year 30 Hours; for the Year conſiſteth of 365 Days and 6 Hours, but by multiplying the Year by 52 Weeks, which is but 364 Days, you loſe 1 Day and 6 Hours every Year; wherefore to find an exact Anſwer, bring the odd Weeks, Days and Hours into Hours, and then multiply the Years by the Number of Hours in the Year, *viz.* 8766, and to the Product add the Hours contained in the odd Time, and you have the exact Time in Hours, which bring into Minutes as before. See the laſt Queſtion thus reſolved:

Week

	Days	*Hours*
28	365	6
8766	24	
172	1466	
172	730	
197	8766 Hours in a Year	
228		
249592 Hours, add 30 min. in Mult.		
60		
14975550 Minutes in 28 Years, 4144 Hours and 30 Minutes.		

Weeks	*Days*	*Hours*
24	4	16
7		
172		
24		
694		
345		
4144 Hours add in (Mult.		

So you see that according to the Methods first used to resolve this Question, the Hours contained in the given Time are 248752; but according to the last, best, or truest Method, they are right, which exceeds the former by 840 Hours.

But for most Occasions it will be sufficient to multiply the given Years by 365, and to the Product add the Days in the odd Time, if there be any, and then there will be only a Loss of 6 Hours in every Year, which may be supplied by taking a fourth Part of the given Years, and adding it to the contained Days, and you have your Desire.

Quest. 24. In 438657540 Minutes, how many Years? *Facit* 834 Years, 4 Days, 19 Hours.

8766 *Years* *Days* *Hours*

6|0)43865754|0(7310959(834 4 19

42 70128
18 29815
18 26298
6 35179
6 35064
57 24)115 (4 Days
54
35 96
30 Rem. (19) Hours
54
54
(0)

Quest. 25. I desire to know how many Hours and Minutes it is since the Birth of our Saviour *Jesus Christ*, being accounted 1756 Years. This

This Queſtion is of the ſame Nature with the 24th foregoing, and after the ſame Manner is reſolved, *viz.* multiply the given Number of Years by 8766, the Product is 15393096 Hours, and that by 60, and the Product is 923585760 Minutes. See the Work.

1756 Years
8766 Hours in a Year
10536
10536
12292
14048
15393096 Hours in 1756 Years
60
923585760 Minutes in 1756 Years

Note, That as Multiplication and Diviſion do interchangeably prove each other, ſo Reduction deſcending and aſcending prove each other by inverting the Queſtion, as the 13th and 14th, and likewiſe the 16th and 17th Queſtions foregoing, by Inverſion, do interchangeably prove each other. The like may be performed for the proof of any Queſtion in Reduction whatſoever.

CHAP. IX.

Of Comparative Arithmetick, viz. *the Relation of Numbers one to another.*

1. COmparative Arithmetick is that which is wrought by Numbers, as they are conſidered to have Relation one to another, and this conſiſts either in Quantity or in Quality. *Vide* Boetius's *Arith. lib.* 1. *cap.* 21.

2. Relation of Numbers in Quantity, is the Reference or Reſpect that the Numbers themſelves have to one another, where the Terms or Numbers propounded are always two, the firſt called the Antecedent, and the other the Conſequent. *See* Wing. *Arithm.*

3. The Relation of Numbers in Quantity conſiſts in the Differences, or in the Rate or Reaſon that is found betwixt the Terms propounded, the Difference of two Numbers being the Remainder found by Subtraction (according to *Alſted*) but the Rate or Reaſon betwixt two Numbers is the Quotient of the Antecedent divided by the Conſequent; ſo 21 and 7 being given, the Difference betwixt them will be found to be 14, but the Rate or Reaſon that is betwixt 21 and 7 will be found to be triple Reaſon, for 21 divided by 7 quotes 3, the Reaſon or Rate.

4. The

4. The Relation of Numbers in Quality (otherwiſe called Proportion) is the Reference or Reſpect that the Reaſon of Numbers have one unto another; therefore the Terms given ought to be more than two. Now this Proportion or Reaſon between Numbers relating one to another, is either Arithmetical or Geometrical.

5. Arithmetical Proportion is, when diverſe Numbers differ one from another by equal Reaſon, that is, have equal Differences, (by ſome called Progreſſion.)

So this Rank of Numbers, 3, 5, 7, 9. 11, 13, 15, 17, differ by equal Reaſon, *viz.* by 2, as you may prove.

6. In a Rank of Numbers that differ by Arithmetical Proportion, the Sum of the firſt and laſt Term being multiplied by half the Number of Terms, the Product is the total Sum of all the Terms

Or, if you multiply the Number of Terms by the half Sum of the firſt and laſt Terms, the Product is the total Sum of all their Terms.

So in the former Progreſſion given, 3 and 17 is 20, which multiplied by 4, *viz.* half the Number of Terms, the Product gives 80, the Sum of all the Terms: Or multiply 8 (the Number of Terms) by 10, half the Sum of the firſt and laſt Terms; the Product gives 80 as before.

So alſo 21, 18, 15, 12, 9, 6, 3, being given, the Sum of all the Terms will be found to be 84; for here the Number of Terms is 7, and the Sum of the firſt and laſt, (*viz.* 21 and 3) is 24, half whereof (*viz.* 12) multiplied by 7, produceth 84, the Sum of the Terms ſought.

7. Three Numbers that differ by Arithmetical Proportion, the Double of the Mean (or middle Number is equal to the Sum of the Extremes.

So 9, 12 and 15 being given, the Double of the Mean 12 (*viz.* 24) is equal to the Sum of the two Extremes, 9 and 15.

8. Four Numbers that differ by Arithmetical Proportion (either continued or interrupted) the Sum of the two Means is equal to the Sum of the two Extremes.

So 9, 12, 18, 21, being given, the Sum of 12 and 18 will be equal to the Sum of 9 and 21, *viz.* 30: Alſo, 6, 8, 14, 16, being given, the Sum of 8 and 14 is equal to the Sum of 6 and 16, *viz.* 22, *&c.* *See* Wingate's *Arith. c.* 35.

9. Geometrical Proportion (by ſome called Geometrical Progreſſion) is when diverſe Numbers differ, according to like Reaſon.

So 1, 2, 4, 8, 16, 32, 64, *&c.* differ by double Reaſon, and 3, 9, 27, 81, 243, 729, differ by triple Reaſon; 4, 16, 64, 256, *&c.* differ by quadruple Reaſon, *&c.*

10. In

10. In any Numbers that increaſe by Geometrical Proportion, if you multiply the laſt Term by the Quotient of any one of the Terms divided by another of the Terms which being leſs is next unto it, and having deducted or ſubtracted the firſt Term out of that Product, divide the Remainder by a Number that is an Unit leſs than the ſaid Quotient, the laſt Quote will be the Sum of all the Terms.

So 1, 2, 4, 8, 16, 32, 64, being given, firſt I take one of the Terms, *viz.* 8, and divide it by the Term which is leſs, and next to it (*viz.* by 4) and the Quotient is 2, by which I multiply the laſt Term 64, and the Product is 128, from whence I ſubtract the firſt Term (*viz.* 1) the Remainder is 127, which divided by the Quotient 2 made leſs by 1, *viz.* 1, the Quote is 127, for the Sum of all the given Terms, as by the Work in the Margent.

```
  64
4) 8 (2
  128
    1
1) 127 (127
```

So if 4, 16, 64, 256, 1024. were given the Sum of all the Terms will be found to be 1364. For firſt I divide 64, one of the Terms, by the next leſſer Term, and the Quotient is 4, by which I multibly the laſt Term 2024, and it produceth 4096; from whence I ſubtract the firſt Term 4, and the Remainder is 4092, which I divide by the Quote leſs by 1, *viz.* 3, and the Quote is 1364, for the total Sum of all the Terms, as *per* Margent.

```
  1024
16) 64 (4
  4096
     4
3) 4092 (1364
```

11. Three Geometrical Proportions given, the Square of the Mean is equal to the Rectangle, or Product of the Extremes.

So 8, 16, 32, being given, the Square of the Mean, *viz.* 16, is 256, which is equal to the Product of the Extremes 8 and 32, for 8 times 32 is equal to 256.

12. Of four Geometrical proportionable Numbers given, the Product of the two Means is equal to the Product of the two Extremes.

So 8, 16, 32, 64, being given, I ſay, that the Product of the two Means, *viz.* 16 times 32, which is 512, is equal to 8 times 64, the Product of the Extremes.

Alſo if 3, 9, 21, 63 were given, which are interrupted, I ſay, 9 times 21 is equal to 3 times 63, which is equal to 189.

From hence ariſeth that precious Gem in Arithmetick, which for the Excellency thereof is called the *Golden Rule*, or *Rule of Three*.

CHAP.

CHAP. X.

The Single Rule of Three Direct.

THE Rule of Three (not undeſervedly called the Golden Rule) is that by which we find out a fourth Number in Proportion unto three given Numbers, ſo as this fourth Number that is ſought may bear the ſame Rate, Reaſon and Proportion to the third (given) Number as the ſecond doth to the firſt; from whence it is alſo called the *Rule of Proportion.*

2. Four Numbers are ſaid to be proportional when the firſt containeth, or is contained by the ſecond, as often as the third containeth, or is contained by the fourth. *Vide* Wingate's *Arith. chap.* 8. *ſect.* 4.

So theſe Numbers are ſaid to be Proportionals, *viz.* 3, 6, 9, 18, for as often as the firſt Number is contained in the ſecond, ſo often is the third contained in the fourth, *viz.* twice: Alſo 9, 3, 15, 5, are ſaid to be Proportionals; for as often as the firſt Number containeth the ſecond, ſo often the third Number containeth the fourth, *viz.* 3 times.

3 The Rule of Three is either ſimple or Compound.

4. The ſimple (or ſingle) Rule of Three conſiſteth of four Numbers, that is to ſay, it hath three Numbers given to find out a fourth; and this is either Direct or Inverſe. *Vide* Alſted. *Math. lib.* 2 *c.* 13.

5. The ſingle Rule of Three Direct, is when the Proportion of the firſt Term is to the ſecond, as the third is to the fourth; or when it is required that the Number ſought, *viz.* the fourth Number, muſt have the ſame Proportion to the ſecond, as the third hath to the firſt.

6. In the Rule of Three, the greateſt Difficulty is to diſcover the Order of the 3 Terms of the Queſtion propounded, *viz.* which is the firſt, ſecond, and the third; which that you may underſtand, obſerve, that of the three given Numbers, two always are of one Kind, and the other is of the ſame Kind with the proportional Number that is ſought; as in this Queſtion, *viz.* If 4 Yards of Cloth coſt 12 Shillings, what will 6 Yards coſt at that Rate? Here the two Numbers of one Kind are 4 and 6, *viz.* they both ſignify ſo many Yards, and 12*s.* is the ſame Kind with the Number ſought, for the Price of 6 Yards is ſought.

Again obſerve, That of the three given Numbers, thoſe two that are of the ſame Kind, one of them muſt be the firſt, and the other the third, and that which is of the

ſame Kind with the Number ſought, muſt be the ſecond Number in the Rule of Three. And that you may know which of the ſaid Numbers to make your firſt, and which your third, know this, that to one of thoſe two Numbers there is always affixed a Demand, and that Number upon which the Demand lieth, muſt always be reckoned the third Number. As in the foremention'd Queſtion, the Demand is affixed to the Number 6; for it is demanded, what 6 Yards will coſt, and therefore 6 muſt be the third Number, and 4 (which is of the ſame Denomination or Kind with it) muſt be the firſt, and conſequently the Number 12 muſt be the ſecond; and then the Numbers being placed in the foremention'd Order, will ſtand as followeth, *viz.*

Yards	*s.*	*Yards*
4	12	6

7. The next Thing is, to find out the fourth Number in Proportion; which that you may do, multiply the ſecond Number by the third, and divide the Product thereof by the firſt, or (which is all one) multiply the third Term (or Number) by the ſecond, and divide the Product thereof by the firſt, and the Quotient thence ariſing is the 4th Number in a direct Proportion, and is the Number ſought, or Anſwer to the Queſtion, and is of the ſame Denomination that the ſecond Number is of; as thus, let the ſame Queſtion be again repeated, *viz.* If 4 Yards of Cloth coſt 12 Shillings, what will 6 Yards coſt?

Having placed my Numbers according to the 6th Rule (of this Chapter) foregoing, I multiply the ſecond Number 12, by the third Number 6, and the Product is 72, which Product I divide by the firſt Number 4, and the Quotient thence ariſing is 18, which is the fourth Proportional or Number ſought, *viz.* 18 Shillings, (becauſe the ſecond Number is Shillings) which is the Price of 6 Yards, as was required by the Queſtion. See the Work following.

	Yards	*s.*	*Yards*	*s.*
If	4	: 12	:: 6	: 18

6

4) 72 (18 Shillings

4

32

32

(0)

Queſt.

Queſt. 2. Another Queſtion may be this, *viz.* If 7 C. of Pepper coſt 21*l.* how much will 16 C. coſt at that Rate?

To reſolve which Queſtion I conſider that (according to the 6th Rule of this Chapter) the Terms or Numbers ought to be placed thus, *viz.* the Demand lying upon 16 C. it muſt be the third Number, and that of the ſame Kind with it muſt be the firſt, *viz.* 7C.; and 21*l.* (being of the ſame Kind with the Number ſought) muſt be the ſecond Number in this Queſtion; then I proceed according to this 7th Rule, and multiply the ſecond Number by the third, *viz.* 21 by 16, and the Product is 336, which I divide by the firſt Number 7, and the Quotient is 48*l.* which is the Value of 16C. of Pepper at the Rate of 21*l.* for 7C. See the Work following.

C.	*l.*	*C.*
7	21	16
	16	
	126	
	21	
7)	336 (48 *l.*	
	28	
	56	
	56 *Facit* 48*l.*	
	(0)	

8. If when you have divided the Product of the ſecond and third Numbers by the firſt, any Thing remain after Diviſion is ended, ſuch Remainder may be multiplied by the Parts of the next inferior Denomination, that are equal to an Unit (or Integer) of the ſecond Number in the Queſtion, and the Product thereof divide by the firſt Number in the Queſtion, and the Quotient is of the ſame Denomination with the Parts by which you multiplied the Remainder, and is Part of the fourth Number which is ſought. And furthermore, if any Thing remain after this laſt Diviſion is ended, multiply it by the Parts of the next inferior Denomination, equal to an Unit of the laſt Quotient, and divide the Product by the ſame Diviſor, (*viz.* the firſt Number in the Queſtion, and the Quote is ſtill of the ſame Denomination with your Multiplier; follow this Method until you have reduced your Remainder into the loweſt Denomination, *&c.* An Example or two will make this Rule very plain, which may be the following.

Queſt.

Queſt. 3. If 13 Yards of Velvet, *&c.* coſt 21*l.* what will 27 Yards of the ſame coſt at that Rate?

Having ordered and wrought my Numbers according to the 6th and 7th Rules of this Chapter, I find the Quotient to be 43*l.* and there is a Remainder of 8, ſo that I conclude the Price of 27 Yards to be more than 43*l.* and to the Intent that I may know how much more, I work according to the foregoing Rule, *viz.* I multiply the ſaid Remainder 8 by 20*s.* (becauſe the ſecond Number in the Queſtion was Pounds) and the Product is 160, which divided by the firſt Number, *viz.* 13, it quotes 12, which are 12 Shillings, and there is yet a Remainder of 4, which I multiply by 12 Pence, (becauſe the laſt Quotient was Shillings) and the Product is 48, which I divide by 13 (the firſt Number) and the Quotient is 3*d.* and yet there remaineth 9, which I multiply by 4 Farthings, and the Product is 36, which divided by 13 again, it quotes 2 Farthings, and there is yet a Remainder of 10, which (becauſe it cometh not to the Value of a Farthing) may be neglected, or rather ſet after the 2 Farthings over the Diviſor with a Line between them, and then (by the 21ſt and 22d Definitions of the firſt Chapter of this Book) it will be $\frac{10}{13}$ of a Farthing; ſo that I conclude, that if 13 Yards of Velvet coſt 21*l.* 27 Yards of the ſame will coſt 43*l.* 12*s.* 3*d* $2\frac{10}{13}$*qrs.* which Fraction is 10 Thirteenths of a Farthing. See the Operation as followeth.

If

yds. *l.* *yds.*
If 13 21 27
27
147
42
13) 567 (43*l.*
52
47
39
Remain (8)
Multiply 20
13)160(12*s.*
13
30
26
Remain (4)
Multiply 12
13) 48 (3*d.*
39
Remain (9)
Multiply 4
qrs.
13) 36(2$\frac{10}{13}$
26
l. *s.* *d.* *qrs.*
Remain 10 *Facit* 43 12 3 2$\frac{10}{13}$

Queſt. 4. Another Example may be this following, *viz.* If 14 Pounds of Tobacco coſt 27 *s.* what will 478 Pound coſt at that Rate?

Work

Work according to the laſt Rule, and you will find it to amount to 921*s.* 10*d.* $1\frac{2}{4}$*qrs.* and by the 5th Rule of the 8th Chapter 921*s.* may be reduced to 46*l.* 1*s.* ſo that then the whole Worth or Value of the 478 *l.* will be 46*l.* 1*s.* 10*d.* $1\frac{3}{4}$*qrs.* The Work followeth.

l. *s.* *l.*
If 14 : 27 : : 478
27

3346
956

2|0
14)12906(92|1)46*l.*

126 8
30 12
28 12
26 (1)
14

Remains (12)
Multiply 12

24
12

14) 144 (10 *d.*

14

Remains (4)
Multiply 4

14) 16 ($1\frac{2}{4}$

Remains (2)
Facit 46*l.* 1*s.* 10*d.* $1\frac{2}{4}$ *qrs.*

9. In

9. In the Rule of Three it many times happens, that altho' the firſt and third Numbers be of one Kind, as both Money, Weight, Meaſure, *&c.* yet they may not be of one Denomination, or perhaps they may both conſiſt of many Denominations; in which Caſe you are to reduce both Numbers to one Denomination, and likewiſe your ſecond Number (if it conſiſteth at any time of diverſe Denominations) muſt be reduced to the leaſt Name mentioned, or lower if you pleaſe; which being done, multiply the ſecond and third together, and divide by the firſt, as is directed in the 7th Rule of this Chapter.

And note, that always the Anſwer to the Queſtion is in the ſame Denomination that your ſecond Number is of, or is reduced to, as was hinted before.

Queſt. 5. If 15 Ounces of Silver be worth 3*l.* 15*s.* what are 86 Ounces worth at that Rate?

In this Queſtion the Numbers being ordered according to the 6th Rule of this Chapter, the firſt and third Numbers are Ounces, and the ſecond Number is of diverſe Denominations, *viz.* 3*l.* 15*s.* which muſt be reduced to Shillings, and the Shillings multiplied by the third Number, and the Product divided by the firſt, gives you the Anſwer in Shillings, *viz.* 430 Shillings, which are reduced to 21*l.* 10*s.*

	oz.		*l.*	*s.*		*oz.*
If	15	:	3	15	::	86

20
75
86
450
600

20 *l.* *s.*

15) 6450 (430 (21 10

60 4
45 3
45 2
(0) (10) *s.*

In reſolving the laſt Queſtion, the Work would have been the ſame if you had reduced your ſecond Number into Pence, for then the Anſwer would have been 5160 Pence, equal to 21*l.* 10*s.* or if you had reduced the ſecond Number into Farthings, the Quotient or Anſwer would have been 20640 Farthings, equal to the ſame, as you may prove at your Leiſure. *Queſt.*

Queſt. 6. If 8 lb of Pepper coſt 4*s.* 8*d.* what will 7 *C.* 3 *qrs.* 14 lb coſt?

In this Queſtion the firſt Number is 8 lb and the third is 7 *C.* 3 *qrs.* 14 lb which muſt be reduced to the ſame Denomination with the firſt, *viz.* into Pounds, and the ſecond Number muſt be reduced into Pence; then multiply and divide according to the 7th Rule foregoing, and you will find the Anſwer to be 6174 Pence, which is reduced into 25*l.* 14*s.* 6*d.*

lb	*s.*	*d.*		*C.*	*qrs.*	lb	
If 1	coſt 4	8	what will	7	3	14	coſt?
	12				4		
	56				31		
					28		
					252		
					63		
					882		
					56		ſecond Number
					5292		
					4410		
				12)		2|0)	*l.* *s.* *d.*
8)	49392			(6174		(51|4	(25 14 6
	48			60		4	
	13			17		11	
	8			12		10	
	59			54		(14) *s.*	
	56			48			
	32			(6) *d.*			
	32						
	(0)		*Facit*			*l.* *s.* *d.* 25 14 6	

Queſt.

Queſt. 7. If 3*C.* 1*qr.* 14*lb* of Raiſins coſt 9*l.* 9*s.* what will 6*C.* 3*qrs* 20*lb* of the ſame coſt?

Here the firſt and third Numbers each conſiſt of diverſe Denominations, but muſt be brought both into one Denomination, &c as you ſee in the Operation that followeth.

If 3 1 14 coſt 9 9 what will 6 3 20 coſt?

4			20			4				
13			189			27				
28						28				
108						216				
27						56				
378 Pounds						776 Pounds				
						189 ſecond Number				
						6984				
						6208				
						776				
							2|0	*l.*	*s.*	
378)	146664)						38|8	19	8	
						1134	2			
						3326	18			
						3024	18			
						3024	(8)			
			l.	*s.*		3024				
		Facit	19	8						
						(0)				

Queſt. 8. If in 4 Weeks I ſpend 13*s.* 4*d.* how long will 53*l.* 6*s.* laſt me at that Rate?

Anſwer 2238 Days, equal to 6 Years, 48 Days. See the Work.

If

s.	*d.*		*W.*		*l.*	*s.*	
If 13	4	require	4	what will	53	6	require?
12			7		20		
30			28 Days		1066		
13					12		
160					2132		
					1066		
					12792 Pence		
					28 ſecond Number		
					102336		
					25584		
					365		
				16|0)358176(22398 (6 Years			
					2190		
				32	Rem. (48) Days		
				38			
				32			
				61	*Years*	*Days*	
				48	*Facit* 6	48 $\frac{96}{120}$	
				137			
				128			
				Remains (96)			

Queſt. 9. Suppoſe the yearly Rent of a Houſe, a yearly Penſion, or Wages, be 73*l.* I deſire to know how much it is *per* Day?

Here you are to bring the Year into Days, and ſay, if 365 Days require 73*l.* what will one Day require?

Now when you come to multiply 73 by 1, the Product is the ſame, for 1 neither multiplieth nor divideth; and 73 cannot be divided by 365, becauſe the Diviſor is bigger than the Dividend; wherefore bring the 73*l.* into Shillings, and they make 1460, which divide by the firſt Number, 365, and the Quote is 4 Shillings for the Anſwer; as you ſee in the Work.

Days	*l.*	*Day*
If 365	73	1
	20	
	365)1460(4 *s.*	
	1460	
	------ *Facit* 4 *s. per Day.*	
	(0)	

Queſt. 10. A Merchant bought 14 Pieces of Broad-cloth, each Piece containing 28 Yards, for which he gave after the Rate of 13*s.* 6*d* ½ *per* Yard, now I deſire to know how much he gave for the 84 Pieces at that Rate?

Firſt find out how many Yards are in the 14 Pieces, which you will do if you multiply the 14 Peiees by 28 (the Number of Yards in a Piece) and it makes 392; then ſay, if 1 Yard coſt 13*s.* 6*d.* ½ what will 392 Yards coſt? Work as followeth, and the Anſwer you will find to be 127400 Half pence, which reduced makes 265*l.* 8*s.* 4*d.* for after you have multiplied your ſecond and third Numbers together, the Product is 127400, which (according to the ſeventh Rule) ſhould be divided by the firſt Number; but the firſt Number is 1, which neither multiplieth nor divideth, and therefore the Quotient, or fourth Number, is the ſame with the Product of the ſecond and third, which is in Half-pence, becauſe the ſecond Number was ſo reduced. See the Work as followeth.

28
14
112
28
392 Yards in the 14 Pieces.

Yd.	*s.*	*d.*		*Yds.*
If 1 coſt	13	6 ½,	what will 392 coſt?	
	12			325 the ſecond Number.
	32			1960
	13			784
	162			1176
	2			---- ---- 2|0
Half-pence	325			24 127400(5308|265 *l.*
				... ...
				120 4
				74 13
				72 12
				200 10
Facit 265*l.* 8*s.* 4*d.*				192 10
				Remains (8) (8) Shillings.
				Half-pence, or 4*d.*

Queſt.

Queſt. 11. A Draper bought 420 Yards of Broad-cloth, and gave for it after the Rate of 14*s.* 10*d.* $\frac{3}{4}$ *per* Ell *Engliſh*, now I demand how much he paid for the Whole after that Rate?

Bring your Ells into Quarters, and your given Yards into Quarters; the Ell is 5 Quarters, and in 420 Yards are 1680 Quarters; then ſay, if 5 Quarters coſt 14*s.* 10*d.* $\frac{3}{4}$ (or 715 Farthings) what will 1680 Quarters coſt? *Facit* 250*l.* 5*s.* See the Operation.

Ells		*Yards*
1		420
5		4
5		1680 *qrs.*

qrs.	*s.*	*d.*			
If 5	: 14	10 $\frac{3}{4}$	::	1680	
	12			715	
	28			8400	
	15			1680	
				11760	
	178 *d.*			96|0	
	4		5)1201200(	24024|0(	250 *l.*
				...	...
	715 *qrs.*		10	192	
			20	482	
			20	480	
			12	rem. (240) *qrs.* or 5*s.*	
			10		
			20		
l.	*s.*	*d.*	20		
Facit 250	5	0	(0)		

Queſt. 12. A Draper bought of a Merchant 50 Pieces of Kerſey, each Piece containing 34 Ells *Flemiſh* (the Ell *Flemiſh* being three Quarters of a Yard) to pay after the Rate of 8*s.* 4*d.* *per* Ell *Engliſh*; I demand how much the 50 Pieces coſt him at that Rate?

Firſt find out how many Ells *Flemiſh* are in the 50 Pieces, by multiplying 50 by 34, the Product is 1700, which bring into Quarters by 3, it makes 5100 Quarters; then proceed as in the laſt Queſtion, and the Anſwer you will find to be 102000 Pence, or 425*l.* See the Operation as followeth.

It

qrs. *s.* *d.* *qrs.*

If 5 : 8 4 :: 5100 50

12 100 34

100 *d.* *d.*

5) 510000 (102000 200

150

5 1700 Ells *Fl.*

10 3

10 5100

(0) (2|0

12) 102000 (850|0 (425*l.*

96 8

60 5

60 4

(0) 10

10

Facit 425*l.* (0)

Quest. 13. A Goldsmith bought a Wedge of Gold which weighed 14*lb* 3*oz.* 8*pwt.* for the Sum of 514*l.* 4*s.* I demand what it stood him in *per* Ounce? *Answer* 60*s.* or 3*l.*

lb *oz.* *pwt.* *l.* *s.* *oz.*

If 14 3 8 : 514 4 :: 1

12 20 Shil. 20

31 10284 20 *pwt.*

14 20 *pwt.*

2|0)

171 *oz.* 3428) 205680 (6|0 (3*l.*

20 6

205680 —

3428 *pwt.* (0) *Facit* 60*s.* or 3*l.*

(0)

Quest.

Queſt. 14. A Grocer bought 4 Hogſheads of Sugar, each weighing neat 6 *C.* 2*qrs.* 14lb which coſt him 2*l.* 8*s.* 6*d.* *per C.* I demand the Value of the 4 Hhds, at that Rate?

Firſt find the Weight of the 4 Hhds, which you may do by reducing the Weight of one of them into Pounds, and multiply them by 4 (the Number of Hhds) and they make 2968lb; then ſay, if 1 *C.* or 112lb coſt 2*l.* 8*s.* 6*d.* what will 2968lb coſt? *Facit* 64*l.* 5*s.* 3*d.* as by the Operation.

C.	*qrs.*	lb
6	2	14
4		
26		
28		
212		
53		
742lb in 1 hhd.		
4 hogſheads		
2968 lb in 4 hhds.		

lb	*l.*	*s.*	*d.*		lb	
If 112	: 2	8	6	::	2968	
20					582	
48					5936	
12					23744	
102					14840	
48					1727376	
582						

112) 1727376 (15423

112	12	12
607	34	8
560	24	8
473	102	(5) Shillings
448	96	
257	63	
224	60	
336		(3) Pence
336		
(0)		

12) 2|0 (128|5 (64*l.*

Facit 64*l.* 5*s.* 3*d.*

Queſt.

Queſt. 15. A Draper bought of a Merchant 8 Packs of Cloth, each containing 4 Parcels, and each Parcel 10 Pieces, and each Piece 26 Yards, and gave after the Rate of 4*l.* 16*s.* for 6 Yards, now I deſire to know how much he gave for the Whole? *Anſwer* 6656*l.*

Firſt find out how many Yards there were in the 8 Packs, and by the following Work you will find there are 8320 Yards: then ſay, if 6 Yards coſt 4*l.* 16*s.* what will 8320 Yards coſt, *&c.*

8 Packs
4
32 Parcels
10
320
26
1920
640
8320 Yards

Yds.	*l.*	*s.*	*Yds.*
6	4	16	8320
	20		96
	96		49920
			74880
			2|0

6)798720(133120(6656 *l.*

6	12
19	13
18	12
18	11
18	10
7	12
6	12
12	(0)
12	
(0)	

Facit 6656*l.*

By this time the Learner is, as I ſuppoſe, well exerciſed in the Practick and Theorick of the *Rule of Three Direct*; but at his Leiſure he may look over the following Queſtions, whoſe Anſwers are given, but the Operation purpoſely omitted as a Touchſtone for the Learner, thereby to try his Ability in what hath been deliver'd in the former Rules.

Queſt. 16. If 24*l.* of Raiſins coſt 6*s.* 6*d.* what will 18 Frails coſt, each weighing neat 33*rs.* 18*l.* *Anſwer* 24*l.* 17*s.* 3*d.*

Queſt. 17. If an Ounce of Silver be worth 5 Shillings, what is the Price of 14 Ingots, each Ingot weighing 7*l.* 5*oz.* 10*pw.* *Anſwer* 313*l.* 5*s.*

Queſt.

Queſt. 18. If a Piece of Cloth coſt 10*l.* 16*s.* 8*d.* I demand how many Ells *Engliſh* there are in the ſame, when the Ell at that Rate is worth 8*s.* 4*d.* *Anſwer* 26 Ells *Engliſh.*

Queſt. 19. A Factor bought 84 Pieces of Stuffs, which coſt him in all 537*l.* 12*s.* at 5*s.* 4*d.* *per* Yard, I demand how many Yards there were in all, and how many Ells *Engliſh* were contained in a Piece of the ſame? *Anſwer* 2016 Yards in all, and 19$\frac{1}{5}$ Ells *Engliſh per* Piece.

Queſt. 20. A Draper bought 242 Yards of Broad-cloth, which coſt him in all 254*l.* 10*s.* for 86 Yards of which he gave after the Rate of 21*s.* 4*d.* *per* Yard. I demand how much he gave *per* Yard for the Remainder? *Anſwer* 20*s.* 10*d.* $\frac{6}{11}\frac{4}{8}$ *per* Yard.

Queſt. 21. A Factor bought a certain Quantity of Serge and Shalloon, which together coſt him 26*l.* 14*s.* 10*d.* The Quantity of Serge he bought was 48 Yards, at 4*s.* 4*d.* *per* Yard; and for every two Yards of Serge he had 5 Yards of Shalloon; I demand how many Yards of Shalloon he had, and how much the Shalloon coſt him *per* Yard?

Anſ. 120 Yards of Shalloon at 2*s.* 8*d.* $\frac{4}{10}$ *per* Yard?

Queſt. 22. An Oilman bought three Tuns of Oil, which coſt him 151*l.* 14*s.* and ſo it chanced that it leaked out 85 Gallons; but he is minded to ſell it again, ſo that he may be no Loſer by it; I demand how he muſt ſell it *per* Gallon? *Anſwer,* at 4*s.* 6*d.* $\frac{7}{11}\frac{7}{9}$*d* *per* Gallon.

Queſt. 23. Bought 6 Packs of Cloth, each Pack containing 12 Cloths, which at 8*s.* 4*d.* Ell *Flemiſh,* coſt 1080*l.* I demand how many Yards there were in each Cloth?

Anſwer, 27 Yards in each Cloth?

Queſt. 24. A Gentleman hath 536*l.* *per Ann.* and his Expences are, one Day with another 18*s.* 10*d.* 3*qrs.* I deſire to know how much he layeth up at the Year's End? *Anſwer* 191*l.* 3*s.* 0*d.* 1*qr.*

Queſt. 25. A Gentleman expendeth daily one Day with another 27*s.* 10*d.* $\frac{1}{2}$, and at the Year's End layeth up 340*l.* I demand how much is his yearly Income? *Anſwer* 848*l.* 14*s.* 4*d.* $\frac{1}{2}$

Queſt. 26. If I ſell 14 Yards for 10*l.* 10*s.* how many Ells *Flemiſh* ſhall I ſell for 283*l.* 17*s.* 6*d.* at that Rate? *Anſwer* 504 $\frac{2}{3}$ Ells *Flemiſh.*

Queſt. 27. If 100*l.* in 12 Months, gain 6*l.* Intereſt, how much will 75*l.* gain in the ſame Time, and at the ſame Rate? *Anſwer* 4*l.* 10*s.*

Queſt.

Queſt. 28. If 100*l.* in 12 Months, gain 6*l.* Intereſt, how much will it gain in 7 Months at that Rate? *Anſw.* 3*l.* 10*s.*

Queſt. 29. A certain Uſurer put out 75*l.* for 12 Months, and received Principal and Intereſt 81*l.* I demand at what Rate *per Cent.* he received Intereſt? *Anſwer* 8*l. per Cent.*

Queſt. 30. A Grocer bought 2 Cheſts of Sugar, the one weigh'd neat 18*C.* 3*qrs.* 14*lb* at 2*l.* 6*s.* 8*d. per C.* the other weigh'd neat 18*C.* 1*qr.* 21*lb* at 4*d.* $\frac{1}{2}$ *per lb* which he mingled together; now I deſire to know how much a *C. wt.* of this Mixture is worth? *Anſw.* 2*l.* 4*s.* 4*d.* 1 $\frac{130}{441}$ *qrs.*

Queſt. 31. Two Men, *viz. A* and *B* departed both from one Place, the one goes *Eaſt*, and the other *Weſt*; one travelleth 4 Miles a Day, and the other 5 Miles a Day, how far are they diſtant, the 9th Day after their Departure? *Anſwer* 81 Miles.

Queſt. 32. *A*, flying every Day 40 Miles, is purſued the fourth Day after by *B*, poſting 50 Miles a Day? Now the Queſtion is, in how many Days, and after how many Miles Travel will *A* be overtaken?

Anſw. B overtakes him in 12 Days, when they have travelled 600 Miles. See *More*'s Arithm. cap. 8. qu. 7

11. The general Effect of the Rule of Three Direct, is contained in the Definition of the ſame, that is, to find a fourth Number in Proportion, conſiſting of two equal Reaſons; as hath been fully ſhewn in all the foregoing Examples.

The ſecond Effect is, by the Price or Value of one Thing, to find the Price and Value of many Things of like Kind.

The third Effect is, by the Price or Value of many Things, to find the Price of one; or by the Price of many Things, (the ſaid Price being one) to find the Price of many Things of like Kind.

The fourth Effect is, by the Price or Value of many Things, to find the Price or Value of many Things of like Kind.

The fifth Effect is, thereby to reduce any Number of Moneys, Weights, or Meaſures, the one Sort to the other, as in the Rules of Reduction contained in the eighth Chapter foregoing. Examples of its various Effects have been already anſwered.

12. The Rule of Three Direct is thus proved, *viz.* multiply the firſt Number by the fourth, and note the Product; then multiply the ſecond Number by the third, and if this Product is equal to the Product of the firſt and fourth, then the Work is rightly performed, otherwiſe it is erroneous. *The Proof of the Rule of Three Direct.*

So the first Question of this Chapter, (whose Answer or fourth Number we found to be 18*s.*) is thus proved, *viz.* the first Number is 4, which multiplied by 18 (the fourth) produced 72, and the second and third Numbers are 12 and 16, which multiplied together produceth 72, equal to the Product of the first and fourth, and therefore I conclude the Work to be rightly performed.

Always observing, that if any Thing remain after you have divided the Product of the second and third Numbers by the first, such Remainder in proving the same must be added to the Product of the first and fourth Numbers, whose Sum will be equal to the product of the second and third, the second Number being of the same Denomination with the fourth, and the first of the same Denomination with the third.

So the fourth Question of this Chapter being again repeated, *viz.* if 142lb of Tobacco cost 27*s.* what will 478lb cost at that Rate? The Answer (or fourth Number) was 40*l.* 1*s.* 10*d.* 1*qr.* $\frac{1}{14}$, which is thus proved, *viz.* bring the fourth Number into Farthings, and it makes 44294, which multiplied by the first Number 14, produceth 619488 (the second which remaineth being added thereto); then, because I reduce my fourth Number into Farthings, I reduce my second (*viz.* 27*s.*) into Farthings, and they are 1296, which multiplied by the third Number 478, their Product is 619488, equal to the product of the first and fourth Numbers, wherefore I conclude the Operation to be true. This is an infallible Way to prove the Rule of Three Direct, and it is deduced from the 12th Section of the 9th Chapter of this Book.

And thus much for this inestimable Rule of Three Direct, the Demonstration of which may be seen in *Kersey's* Appendix to *Wingate's* Arithmetick, and in the 6th Chapter of *Oughtred's Clavis Mathematicæ.*

CHAP. XI.

The Single Rule of Three Inverse.

1. THE Golden Rule, or Rule of Three Inverse, is when there are three Numbers given, to find a fourth in such proportion to the three given Numbers, so as the fourth proceeds from the second, according to the same Rate, Reason or proportion, that the first proceeds from the third, or the proportion is.

As

As the third Number is in proportion to the ſecond, ſo is the firſt to the fourth. See *Alſted. Math.* l. 2. c. 14.

So if the three given Numbers were 8, 12 and 16, and it were required to find a fourth Number in an inverted proportion to theſe, I ſay, that as 16 (the third Number) is the Double of the firſt Term or Number (8) ſo muſt 12, the ſecond Number, be the Double of the fourth: ſo will you find the fourth Term or Number to be 6. And (as in the Rule of Three Direct) you multiply the ſecond and third together, and divide their Product for a fourth proportional Number.

2. In the Rule of Three Inverſe, you muſt multiply the ſecond Term by the firſt, or firſt Term by the ſecond, and divide the Product thereof by the third Term, ſo the Quotient will give you the fourth Term ſought in an inverted Proportion. The ſame Order being obſerved in this Rule as in the Rule of Three Direct, for placing and diſpoſing of the given Numbers, and after your Numbers are placed in Order, that you may know whether your Queſtion be to be reſolved by the Rule Direct or Inverſe, obſerve the general Rule following.

3. When your Queſtion is ſtated, and your Numbers orderly diſpoſed, conſider in the firſt Place whether the fourth Term or Number ſought ought to be more or leſs than the ſecond Term, which you may eaſily do; and if it is required to be more or greater than the ſecond Term, then the leſſer Extreme muſt be your Diviſor; but if it requires leſs, then the higheſt Extreme muſt be your Diviſor; in this Caſe the firſt and third Numbers are called Extremes (in reſpect of the ſecond) and having found out your Diviſor, you may know whether your Queſtion belong to the Rule Direct or Inverſe; for if the third Term be your Diviſor, then it is Inverſe, but if the firſt Term be your Diviſor, then it is a Direct Rule: As in the following Queſtions.

Queſt. 1. If 8 Labourers can do a certain piece of Work in 12 Days, in how many Days will 16 Labourers do the ſame? *Anſwer*, in 6 Days.

Having placed the Numbers according to the 6th Rule of the 10th Chapter, I conſider, that if 8 Men can finiſh the Work in 12 Days, 16 Men will do it in leſſer (or fewer Days) than 12, therefore the bigger Extreme muſt be the Diviſor, which is 16, and therefore it is the Rule of Three Inverſe; wherefore I multiply the firſt and ſecond Numbers together, *viz.* 8 by 12,

Lab.	*Days*	*Lab.*
8	12	16

8

16) 96 (6 Days

96

(0)

Facit 6 Days.

vided by 16, quotes 6 Days for the Anſwer; and in ſo many Days will 16 Labourers perform a piece of Work, when 8 Men can do it in 12 Days.

Queſt. 2. If when the Meaſure, *viz.* (a Peck) of Wheat coſt 2*s.* the Penny Loaf weighed (according to the Standard, Statute or Law of *England*) 8 Ounces, I demand how much it will weigh when the Peck is worth 1*s.* 6*d.* according to the ſame Rate or proportion? *Anſwer* 10 *oz.* 13 *pwt.* 8 *gr.*

Having placed and reduced the given Numbers according to the 6th and 9th Rules of the 10th Chapter, I conſider, that at 1*s.* 6*d.* *per* Peck, the Penny Loaf will weigh more than at 2*s.* *per* Peck; for as the Price decreaſeth, the Weight increaſeth; and as the Price increaſeth, ſo the Weight diminiſhes; wherefore, becauſe the firſt Term requires more than the ſecond, the leſſer Extreme muſt be the Diviſor, *viz.* 1*s.* 6*d.* or 18*d.* and having finiſhed the Work, I find the Anſwer to be 10*oz.* 13*pwt.* 8*gr.* and ſo much will the Penny Loaf weigh when the Peck of Wheat is worth 1*s.* 6*d.* according to the given Rate of 8 Ounces when the Peck is worth 2*s.* The Work is plain in the following Operation.

```
         d.   oz.   gr.
     If 24     8     18
         8
        ------oz. pwt. gr.
  18)  192 (10   13   8 Anſw.
       18
       ---
        12
        20
       ----pwt.
       240 (13
        18
       ---
        60
        54
       ---
         6)
        24
       ---
       144 (8 gr.
       144
       ---
       (0)
```

Queſt. 3. How many Pieces of Money or Merchandize, at 20 *s.* *per* Piece, are to be given or received for 240 Pieces, the Value or Price of every Piece being 12 Shillings? *Anſ.* 144 Pieces. For if 12*s.* required 240 Pieces, then 20*s.* will require leſs; therefore the bigger Extreme muſt be the Diviſor, which is the third Number, *&c.* See the Work as in the Margent.

s.	*pcs.*	*s.*
If 12	240	20
	12	
	480	
	240	
20)	2880	(144 *pcs.* at 20*s.* *per* pc.
	2	
	8	
	8	
	8	
	8	
	(0)	

Queſt. 4. How many Yards of 3 Quarters broad are required to double or be equal in Meaſure to 30 Yards that are 5 Quarters broad? *Anſwer* 50 Yards. For ſay, if 5 Quarters will require 30 Yards long, what Length will 3 Quarters broad require? Here I conſider that 3 Quarters broad will require more Yards than 30; for the narrower the Cloth is, the more in Length will go to make equal Meaſure with a broader Piece.

qrs.	*long*	*qrs.*
5	30	3
	5	
	3) 150	(50 *Yards*
	15	
	(0)	

Queſt. 5. At the Requeſt of a Friend I lent him 200*l.* for 12 Months, promiſing to do me the like Courteſy at my Neceſſity; but when I came to requeſt it of him, he could let me have but 150*l.* now I deſire to know how long I may keep this Money to make plenary Satisfaction for my former Kindneſs to my Friend? *Anſ.* 16 Months. I ſay, if 200*l.* require 12 Months, what will 150*l.* require? 150*l.* will require more Time than 12 Months, therefore the leſſer Extreme (*viz.* 150) muſt be the Diviſor; multiply and divide, and you will find the fourth inverted Proportional to be 16, and ſo many Months I ought to keep the 150*l.* for Satisfaction.

Queſt. 6. If for 24*s.* I have 1200*lb* Weight carried 36 Miles, how many Miles ſhall 1800*lb* be carried for the ſame Money? *Anſwer* 24 Miles

Queſt. 7. If for 24*s.* I have 1200*lb* Weight carried 36 Miles, how many *lb* Weight ſhall I have carried 24 Miles for the ſame Money? *Anſwer* 1800 *lb* Weight.

Queſt.

Queſt. 8. If 100 Workmen in 12 Days finiſh a Piece of Work or Service, how many Workmen are ſufficient to do the ſame in 3 Days? *Anſwer* 400 Workmen.

Queſt. 9. A Colonel is beſieged in a Town, in which are 1000 Soldiers, with Proviſion of Victuals only for 3 Months; the Queſtion is, how many of his Soldiers muſt he diſmiſs, that his Victuals may laſt the remaining Soldiers 6 Months? *Anſwer* 500 he muſt keep, and diſmiſs as many.

Queſt. 10. If 20*l.* worth of Wine is ſufficient for the Ordinary of 100 Men, when the Tun is ſold for 30*l.* how many Men will the ſame 20*l.* worth ſuffice, when the Tun is worth 24*l.*? *Anſwer* 125 Men.

Queſt. 11. How much Pluſh is ſufficient for the Cloak which hath in it 4 Yards of 7 Quarters wide, when the Pluſh is but 3 Quarters wide? *Anſ.* 9 $\frac{1}{3}$ Yards of Pluſh.

Queſt. 12. How many Yards of Canvas, that is Ell wide, will be ſufficient to line 20 Yards of Say that is 3 Quarters wide? *Anſwer* 12 Yards.

Queſt. 13. How many Yards of Mattin that is 2 Foot wide, will cover a Floor that is 24 Foot long and 20 Foot broad? *Anſwer* 80 Yards.

Queſt. 14. A Regiment of Soldiers conſiſteth of 1000, and to have new Coats, and each Coat to contain two Yards two Quarters of Cloth that is 5 Quarters wide, and they are to be lined with Shalloon that is 3 Quarters wide, I demand how many Yards of Shalloon will line them? *Anſwer* 16666 $\frac{2}{3}$ Quarters, or 4166 $\frac{2}{3}$ Yards.

Queſt. 15. A Meſſenger makes a Journey in 24 Days, when the Day is 12 Hours long; I deſire to know in how many Days he will go the ſame, when the Day is 16 Hours long? *Anſwer* in 18 Days.

Queſt. 16. I borrowed of my Friend 64*l.* for 8 Months, and he hath Occaſion another Time to borrow of me for 12 Months I deſire to know how much I muſt lend to make good his former Kindneſs to me? *Anſwer* 42*l.* 13*s.* 4*d.*

4. The general Effect of the Rule of Three Inverſe, is contained in the Definition of the ſame, that is, to find a fourth Term in a reciprocal Proportion inverted to the Proportion given.

The ſecond Effect is, by two Pieces, or Value of two ſeveral Pieces of Money and Merchandize known, to find how many Pieces of the one Price is to be given for ſo many of the other; and ſo to reduce and exchange one Sort of Money or Merchandize into another. Or elſe to find the Price unknown of any Piece given to exchange in reciprocal Proportion.

The

The third Effect is, by two different Prices of a Meaſure of Wheat bought or ſold, and the Weight of a Loaf of Bread, made anſwerable to one of the Prices of the Meaſure given, to find out the Weight of the ſame Loaf anſwerable to the other Price of the ſaid Meaſure given.

Or elſe, by the two ſeveral Weights of the ſame priced Loaf, and the Price of the Meaſure of Wheat anſwerable to one of thoſe Weights given, to find out the other Price of the Meaſure anſwerable to the other Weight of the ſame Loaf.

The fourth Effect is, by two Lengths and one Breadth of two rectangular Planes known, to find out another Breadth unknown. Or, by two Breadths and one Length given, to find out another Length unknown in an inverted Proportion.

The fifth Effect is, by double Time and a capital Sum of Money borrowed or lent, to find out another capital Sum anſwerable to one of the given Times; or otherwiſe, by two capital Sums, and a Time anſwerable to one of them given, to find out a Time anſwerable to the other capital Sum in reciprocal Reaſon.

The ſixth Effect is, by two different Weights of Carriage, and the Diſtance of the Place in Leagues or Miles given, to find another Diſtance in Miles anſwerable to the ſame Price of Payment. Or otherwiſe, by two Diſtances in Miles, and the Weight anſwerable to one of the Diſtances (being carried for a certain Price) to find out the Weight anſwerable to the other Diſtance for the ſame Price.

The ſeventh Effect is, by double Workmen, and the Time anſwerable to one of the Numbers of Workmen given, to find out the Time anſwerable to the other Number of Workmen, in the Performance of any Work or Service. Or contrarywiſe, by double Time, and the Workmen anſwerable to one of thoſe Times given, to find out the Number of Workmen anſwerable to the other Time, in the Performance of any Work or Service.

Alſo by a double Price of Proviſion, and the Number of Men or other Creatures nouriſhed for a certain Time, anſwerable to one of the prices of Proviſion given, to find out another Number of Men or other Creatures anſwerable to the other price of the Proviſion for the ſame Time. Or contrarywiſe, by two Numbers of Men or other Creatures nouriſhed, and one price of Proviſion anſwerable to one of the Numbers of Creatures given, to find out the other price of the ſame Proviſion anſwerable to the other Number of Creatures, both being ſuppoſed to be nouriſhed for the ſame, *&c.*

To prove the Operation of the Rule of Three Inverſe, multiply the 3d and 4th Terms together, and note their Product, and multiply the 1ſt and 2d together, and if their Product is equal to the Product of the 3d and 4th, then is the Work truly wrought, but if it falleth out otherwiſe, then it is erroneous.

As in the firſt Queſtion of this Chapter, 16 (the third Number) being multiplied by 6 (the fourth Number) the Product is 96, and the Product of 8 (the firſt Number) multiplied by 12 (the ſecond Number) is 96, equal to the firſt Product, which proves the Work to be right.

And note, That if in Diviſion any Thing remain, ſuch Remainder muſt be added to the Product of the third and fourth Terms, and if the Sum be equal to the Product of the firſt and ſecond) the homogeneal Terms being of one Denomination, the Work is right.

CHAP. XII.

The Double Rule of Three Direct.

WE have already delivered the Rule of ſingle Proportion, and we come now to lay down the Rules of plural Proportion.

1. Plural Proportion is, when more Operations in the Rule of Three than one are required before a Solution can be given to the Queſtion propounded. Therefore in Queſtions that require Plurality in Proportion, there are always given more than three Numbers.

2. When there are given five Numbers, and a ſixth is required in proportion thereunto, then the ſixth Proportion is ſaid to be found out by the Double Rule of Three, as in the Queſtion following, *viz.*

If 100*l.* in 12 Months gain 6*l.* Intereſt, how much will 75*l.* gain in 9 Months?

3. Queſtions in the Double Rule of Three may be reſolved either by two ſingle Rules of Three, or by one ſingle Rule of Three compounded of the five given Numbers.

4. The Double Rule of Three is either Direct or elſe Inverſe.

5. The Double Rule of Three Direct is, when unto 5 given Numbers, a 6th Proportional may be found out by two ſingle Rules of Three Direct.

6. The 5 given Numbers in the Double Rule of Three Direct conſiſt of two Parts, *viz.* 1. A Suppoſition, and 2dly, of a Demand: The Suppoſition is contained in the three firſt of the five given Numbers, and the Demand lies in

in the two laſt, as in the Example of the ſecond Rule of this Chapter, *viz.* If 100*l.* in 12 Months gain 6*l.* Intereſt, what will 75*l.* gain in 9 Months? Here the Suppoſition is expreſſed in 100, 12, and 6; for it is ſaid, if 100*l.* in 12 Months gain 6*l.* Intereſt: And the Demand lieth in 75 and 9; for it is demanded, How much 75*l.* will gain in 9 Months.

7. When your Queſtion is ſtated, the next Thing will be to diſpoſe of the given Numbers in due Order and Place, as a preparative for Reſolution; which that you may do, firſt, Obſerve which of the given Numbers in the Suppoſition is of the ſame Denomination with the Number required, for that muſt be the 2d Number (in the firſt Operation) of the Single Rule of Three, and one of the other Numbers in the Suppoſition (it matters not which) muſt be the firſt Number, and that Number in the Demand, which is of the ſame Denomination with the firſt, muſt be the third Number; which three Numbers being thus placed, will make one perfect Queſtion in the Single Rule of Three, as in the forementioned Example; firſt, I conſider, that the Number required in the Queſtion, is in the Intereſt or Gain of 75*l.* therefore that Number in the Suppoſition which hath the ſame Name, *viz.* 6*l.* which is the Intereſt or Gain of 100*l.* muſt be the ſecond Number in the firſt Operation, and either 100 or 12 (it matters not which) muſt be the firſt Number, but I will take 100; and then for the third Number, I put that Number in the Demand which hath the ſame Denomination with 100, which is 75, for they both ſignify Pounds principal, and then the Numbers will ſtand as you ſee in the Margent.

100 : 6 : 75

But if I had for the firſt Number put the other Number in the Suppoſition, *viz.* 12, which ſignifies 12 Months, then the third Number muſt have been 9, which is the Number in the Demand which hath the ſame Denomination with the firſt, *viz.* 9 Months, and they will ſtand as in the Margent.

12 6 9

There yet remains two Numbers to be diſpoſed of, and thoſe are one in the Suppoſition, and another in the Demand; that which is of the Suppoſition, I place under the firſt of the three Numbers; and the other, which is the Demand, I place under the third Number; and then two of the Terms in the Suppoſition will ſtand (one over the other) in the firſt Place, and the two Terms in the Demand will ſtand (one over the other) in the third place, as in the Margent.

100 6 75
12 9
Or this,
12 6 9
100 75

1. Having disposed or ordered the given Numbers according to the last Rule, we may proceed to a Resolution: And first I work with the 3 uppermost Numbers, which, according to the first Disposition are 100 : 6 :: and 75; which is as much as to say, if 100*l.* requires 6*l.* Interest, how much will 75*l.* require? Which, by the third Rule of the 11th Chapter, I find to be Direct, and by the 7th and 8th Rules of the 10th Chapter, I find the 4th proportional Number to be 4*l.* 10*s.* so that by the foregoing single Question I have discovered how much Interest 75*l.* will gain in 12 Months; the Operation whereof followeth on the left Hand under the Letter A: And having discovered how much it will gain in 12 Months, we may by another Question easily discover how much it will gain in 9 Months; for this 4th Number (thus found) I put in the Middle between the two lowest Numbers of the 5, after they are placed according to the 7th Rule of this Chapter, and then it will be a second Number, in another Question in the Rule of Three. The Numbers being

M.	*l.*	*s.*	*M.*
12	4	10	9

the first and third Numbers being of one Denomination, *viz.* both Months, and may be thus expressed; if 12 Months require 4*l.* 10*s.* Interest, what will 9 Months require? And by the third Rule of the 11th Chapter, I find it to be the Direct Rule, and by working according to the Directions laid down in the 7th, 8th and 9th Rules of the 10th Chapter, I find the fourth proportional Number to the last single Question to be 3*l.* 7*s.* 6*d.* which is the sixth proportional Number to the five given Numbers, and is the Answer to the general Question. The Work of the last single Question is expressed on the right Side of the Page, under the Letter B, as followeth.

100

A

100
12
l. *l.* *l.*
If 100 6 75
75
30
42
1|00)4|50(4 10
4
Rem. (50)
Mult. 20
100) 1000 (10*s.*
l. *s.*
Facit 4 10

—6—75
9
B
Then say,
M. *l.* *s.* *M.*
If 12 4 10 9
20
90
12
180
90
1080 Pence
9
12 20 *l.* *s.* *d.*
12)9720(810(67 (3 7 6
96 72
7 *s.*
12 90
12 84
(0) (6) *d.*
Facit 3*l.* 7*s.* 6*d.*

So that by the foregoing Operation I conclude, that if, 100*l.* in 12 Months, gain 6*l.* Intereſt, 75*l.* will gain 3*l.* 7*s.* 6*d.* in 9 Months, after the ſame Rate. The Anſwer would have been the ſame if the 5 given Numbers had been ordered according to the ſecond Method, *viz* as you ſee in the Margent.

12 6 9
100 75

For firſt, I ſay, if 12 Months gain 6*l.* what will 9 Months gain? This Queſtion I find to be Direct, by the 3d Rule of the 11th Chapter, and by the 7th and 8th Rules of the 10th Chapter, I find the fourth proportional Number to theſe three to be 4*l.* 10*s.*

Thus have I found out what is the Intereſt of 100*l.* for 9 Months, and am now to find the Intereſt of 75*l.* for 9 Months; to effect which, I make this fourth Number (found as before) to be my ſecond Number in the next Queſtion, I ſay, if 100*l.* require 4*l.* 10*s.* what will 75*l.* require? This Queſtion I find (by the ſaid 3d Rule of the 11th Chapter) to be Direct, and by the ſaid 7th, 8th, and 9th Rules of the 10th Chapter, I find the Anſwer to be as before, *viz.* 3*l.* 7*s.* 6*d.*

The Operation of this Rule in the following Queſtions, are purpoſely omitted, to try the Learner's Capacity.

Queſt.

Queſt. 2. A ſecond Example in this Rule may be as followeth, *viz.* A Carrier receiving 42*s.* for the Carriage of 3 C. Weight 150 Miles, I demand how much he ought to receive for the Carriage of 7 *C.* 3*qrs.* 14*lb* 50 Miles at that Rate? *Anſwer* 36*s.* 9*d.*

Queſt. 3. A Regiment of 936 Soldiers eat up 351 Quarters of Wheat in 168 Days, I demand how many Quarters of Wheat 11232 Soldiers will eat in 56 Days at that Rate? *Anſwer* 1404 Quarters.

Queſt. 4. If 40 Acres of Graſs be mowed by 8 Men in 7 Days, how many Acres ſhall be mowed by 24 Men in 28 Days? *Anſwer* 480 Acres.

Queſt. 5. If 48 Buſhels of Corn (or other Seed) yield 576 Buſhels in a Year, how much will 240 Buſhels yield in 6 Years at that Rate? That is to ſay, if there were ſowed 240 Buſhels every one of the 6 Years? *Anſwer* 17280 Buſhels.

Queſt. 6. If 40 Shillings be the Wages of 8 Men for 5 Days, what will be the Wages of 32 Men for 24 Days? *Anſwer* 768 Shillings, or 38*l.* 8*s.*

Queſt. 7. If 14 Horſes eat 56 Buſhels of Provender in 16 Days, how many Buſhels will 20 Horſes eat in 24 Days? *Anſwer* 120 Buſhels.

Queſt. 8. If 8 Cannons in one Day ſpend 48 Barrels of Powder, I demand how many Barrels 24 Cannons will ſpend in 12 Days at that Rate? *Anſwer* 1728 Barrels.

Queſt. 9. If in a Family conſiſting of 7 Perſons, there are drank out 2 Kilderkins of Beer in 12 Days, how many Kilderkins will there be drank out in 8 Days, by another Family conſiſting of 14 Perſons? *Anſwer* 48 Gallons, or 2 Kilderkins and 12 Gallons.

Queſt. 10. An Uſurer put 75*l.* out, to receive Intereſt for the ſame, and when it had continued 9 Months, he received for Principal and Intereſt 78*l.* 7*s.* 6*d.* I demand at what Rate *per cent. per annum* he received Intereſt? *Anſwer* 6*l.* *per cent. per annum.*

CHAP. XIII.

The Double Rule of Three Inverſe.

THE Double Rule of Three Inverſe is, when a Queſtion in the Double Rule of Three is reſolved by two ſingle Rules of Three, and one of thoſe ſingle Rules falls out to be Inverſe, or requires a fourth Number in Proportion reciprocal (for both Queſtions are never Inverſe.)

2. In

2. In all Queſtions of the Double Rule of Three (as well Inverſe as Direct) you are, in the diſpoſing of the 5 given Numbers, to obſerve the 7th Rule of the 12th Chap. and in reſolving of it by two ſingle Rules, obſerve to make choice of your Numbers for the firſt and ſecond ſingle Queſtions, according to the Directions given in the 8th Rule of the ſame Chapter, and in the Example following, *viz.*

Queſt. 1. If 100*l.* Principal in 12 Months gain 6*l.* Intereſt, what Principal will gain 3*l.* 7*s.* 6*d.* in 9 Months?

This Queſtion is an Inverſion of the firſt Queſtion of the 12th Chapter, and may ſerve for a Proof thereof.

In order to a Reſolution, I diſpoſe of the 5 given Numbers, according to the 7th Rule of the laſt Chapter; and being ſo diſpoſed, they will ſtand as follow.

12 100 9
6 3 7 6

Or thus,

l. *l.* *s.* *d.*
6 100 3 7 6
12 9

Here obſerve, That according to the 7th Rule of the 12th Chapter, the firſt Queſtion (if you take it from the 5 Numbers, as they are ordered or placed firſt) will be, if 12 Months require 100*l.* Principal, what will 9 Months require to make the ſame Intereſt? This (according to the 3d Rule of the 11th Chapter) is Inverſe, and the Anſwer will be found (by the 2d Rule of the 11th Chapter) to be 133*l.* 6*s.* 8*d* The ſecond Queſtion then will be, if 6*l.* Intereſt require 133*l.* 6*s.* 8*d.* Principal; how much Principal will 3*l.* 7*s.* 6*d.* require? This is a direct Rule, and the Anſwer in a direct Proportion is 75*l.* See the Work.

Firſt I ſay,

M. *l.* *M.*
12 100 9

12
9)1200(133 6 8
..
9 *l.* *s.* *d.*
30 *Facit* 133 6 8
27
30
27
(3)
20
9)60(6*s.*
54
(6)
12
9)72(8*d.*
72
(0)

Then

Then I ſay,

	l.		*l.*	*s.*	*d.*		*l.*	*s.*	*d.*
If	6	:	133	6	8	::	3	7	6
	240		20				20		
	1440 *d.*		2666				67		
			12				12		
			5340				140		
			2666				67		
			32000				8|10 *d*		
			810						
			320000						

256

144|0) 2592000|0 (1800|0 (75*l.*

144 — 168

1152 — 120

1152 — 120

(0) — (0)

So that by the foregoing Work I find that if 6*l.* Intereſt be gained by 100*l.* in 12 Months, 3*l.* 7*s.* 6*d.* will be gained by 75*l.* in 9 Months.

But if the Reſolution had been found out by the Numbers as they are ranked in the ſecond Place, then the ſecond Queſtion in the ſecond Rule would have been Inverſe, and the firſt Queſtion Direct, and the Concluſion the ſame with the firſt Method, *viz.* 75*l.*

Queſt. 2. If a Regiment conſiſting of 936 Soldiers can eat up 351 Quarters of Wheat in 168 Days, how many Soldiers will eat up 1400 Quarters in 56 Days, at that Rate? *Anſwer* 11200 Soldiers.

Queſt. 3. If 12 Students in 8 Weeks ſpend 48*l.* I demand how many Students will ſpend 288*l.* in 18 Weeks? *Anſwer* 32 Students.

Queſt. 4. If 48*l.* ſerve 12 Students 8 Weeks, how many Weeks will 288*l.* ſerve 4 Students? *Anſ.* 144 Weeks.

Queſt. 5. If when a Buſhel of Wheat coſt 3*s.* 4*d.* the Penny Loaf weigheth 12 Ounces, I demand the Weight of the Loaf worth 9*d.* when the Buſhel coſt 10*s.* *Anſ.* 36 *oz.*

Queſt. 6. If 48 Pioneers in 12 Days caſt a Trench 24 Yards long, how many Pioneers will caſt a Trench 168 Yards long in 16 Days? *Anſwer* 252 Pioneers.

Queſt. 7. If 12C.wt being carried 100 Miles, coſt 5*l.* 12*s.* I deſire to know how many C.wt may be carried 150 Miles for 12*l.* 12*s.* at that Rate? *Anſ.* 18C.

Queſt.

Queſt. 8. If when Wine is worth 30*l.* *per* Ton, 20*l.* worth is ſufficient for the Ordinary of 100 Men, how many Men will 4*l.* worth ſuffice when it is worth 24*l.* *per* Ton? *Anſwer* 25 Men.

Queſt. 9. If 6 Men in 24 Days mow 72 Acres, in how many Days will 8 Men mow 24 Acres? *Anſ.* in 6 Days.

Queſt. 10. If when the Ton of Wine is worth 30*l.* 100 Men will be ſatisfied with 20*l.* worth, I deſire to know what the Ton is worth when 4*l.* worth will ſatisfy 25 Men at the ſame Rate? *Anſwer* 24*l.* *per* Ton.

CHAP. XIV.

The Rule of Three compoſed of five Numbers.

THE Rule of Three compoſed is, when Queſtions (wherein there are five Numbers given, to find a ſixth in proportion thereunto) are reſolved by one ſingle Rule of Three compoſed of the five given Numbers.

2. When Queſtions may be performed by the Double Rule of Three Direct, and it is required to reſolve them by the Rule of Three compoſed; firſt order or rank your Numbers according to the 7th Rule of the 12th Chap. then

The Rule is,

Multiply the Terms or Numbers (that ſtand one over the other in the firſt Place) the one by the other, and make their Product the firſt Term in the Rule of Three Direct; then multiply the Terms that ſtand one over the other in the third Place, and place their Product for the third Term in the Rule of Three Direct, and put the middle Term of the 7 uppermoſt for a ſecond Term; then having found a fourth Proportional direct to theſe three, this fourth Proportional ſo found ſhall be the Anſwer required.

So the firſt Queſtion of the 13th Chapter being propoſed, *viz.* if 100*l.* in 12 Months gain 6*l.* Intereſt, what will 75*l.* gain in 9 Months?

The Numbers being ranked or placed as is there directed and done, then I multiply the two firſt Terms 100 and 12 the one by the other, and their Product is 1200 for the firſt Term; then I multiply the laſt two Terms 75 and 9 together, and their Product is 675 for the third Term: Then I ſay, as 1200 is to 6, ſo is 675 to the Anſwer, which by the Rule of Three Direct will be found to be 3*l.* 7*s.* 6*d.* as was before found.

3. But if the Queſtion is to be anſwer'd by the Double Rule of Three Inverſe, then (having placed the 5 given Terms as before) multiply the lowermoſt Term of the firſt Place

Place by the uppermoſt Term of the third Place, and put the Product for the firſt Term; then multiply the uppermoſt Term of the firſt Place by the lowermoſt Term of the third Place, and put the Product for the third Term, and the ſecond Term of the three higheſt Numbers for the middle Term of thoſe two; then if the Inverſe Proportion is found in the uppermoſt three Numbers, the fourth Proportional direct to theſe three ſhall be the Anſwer. So the firſt Queſtion in the 13th Chapter being ſtated, *viz.* if 100*l.* Principal in 12 Months gain 6*l.* Intereſt, what Principal will gain 3*l.* 7*s.* 6*d.* in 9 Months? State the Numbers as there directed in the firſt Order, *viz.*

M.	*l.*	*M.*
12	100	9
l.		*l. s. d.*
6		3 7 6

Then reduce the 6*l.* and 3*l.* 7*s.* 6*d.* into Pence, the 6*l.* is 1440*d.* and 3*l.* 7*s.* 6*d.* is 810*d.* then multiply 1440 by 9, the Product is 12960 for the firſt Term in the Rule of Three Direct, and multiply 810 by 12, the Product is 9720 for the third Term; then I ſay, as 12960 is to 100*l.* ſo is 9720 to the Anſwer, *viz.* 75*l.* as before. But if the Terms had been placed after the ſecond Order, *viz.*

l.		*l.*		*l.*	*s.*	*d.*
6	:	100	: :	3	7	6
M.				*M.*		
12				9		

Then the Inverſe Proportion is found in the loweſt Numbers, and having compoſed the Numbers for a ſingle Rule of Three, as in the ſecond Rule foregoing; then the Anſwer muſt be found by a ſingle Rule of Three Inverſe; for here it falls out to multiply 810 by 12 for the firſt Number, 1440 by 9 for the third Number; and then you muſt ſay, as 9720 is to 100*l.* ſo is 12960 to the Anſwer, which by Inverſe Proportion will be found to be 75*l.* as before.

The Queſtion in the 12th and 13th Chapters may ſerve for thy farther Experience.

CHAP. XV.

Single Fellowſhip.

FEllowſhip is that Rule of Plural Proportion whereby we ballance Accompts depending between diverſe Perſons, having put together a general Stock, ſo that they may every Man have his proportional Part of Gain, or ſuſtain his proportional Part of Loſs.

2 The

2. The Rule of Fellowſhip is either ſingle; or it is double.

3. The ſingle Rule is, when the Stocks propounded are ſingle Numbers, without any reſpect or relation to Time, each Partner continuing his Money in Stock for the ſame Time.

4. In the ſingle Rule of Fellowſhip the Proportion is, as the whole Stock of all the Partners is in proportion to the total Gain or Loſs, ſo is each Man's particular Share in the Stock, to his particular Share in the Gain or Loſs. Therefore take the Total of all the Stocks for the firſt Term in the Rule of Three, and the whole Gain or Loſs for the ſecond Term, and the particular Stock of any one of the Partners for the third Term, then multiply and divide according to the ſeventh Rule of the 9th Chapter, and the fourth proportional Number is the particular Loſs or Gain of him whoſe Stock you made your ſecond Number, wherefore repeat the Rule of Three as often as there are particular Stocks or Partners in the Queſtion, and the fourth Terms produced upon the ſeveral Operations are the reſpective Gain or Loſs of thoſe particular Stocks given, as in the Example following.

Queſt 1. Two Perſons, *viz.* *A* and *B*, bought a Tun of Wine, for 20*l.* of which *A* paid 12*l.* and *B* paid 8*l.* and they gained in the Sale thereof 5*l.* now I demand each Man's Share in the Gain, according to his Stock?

Firſt, I find the Sum of all their Stocks, by adding them together, *viz.* 12*l.* and 8*l.* which are 20*l.* then according to this Rule, I ſay firſt, if 20*l.* (the Sum of their Stocks) require 5*l.* the total Gain, how much will 12*l.* (the Stock of *A*) require? Multiply and divide by the 7th Rule of the 9th Chapter, and the Anſwer is 3*l.* for the Share of *A* in the Gain; then again I ſay, if 20*l.* require 5*l.* what will 8*l.* require? The Anſwer is 2*l.* which it the Gain of *B*; ſo I conclude the Share of *A* in the Gain is 3*l.* and the Share of *B* in the Gain is 2*l.* which in all is 5*l.*

```
   12
    8
  ----
  20l.
```

```
        l.    l.     l.
If     20  :  5  ::  12
              12
          ------
      20) 60 (3 l.
          60
          ---
          (0)
```

```
        l.    l.     l.
If     20  :  5  ::   8
               8
          ------
      20) 40 (2l.
```

Queſt.

Queſt. 2. Three Merchants, *viz. A, B* and *C*, enter upo a joint Adventure, *A* put into the common Stock 78*l.* put in 117*l.* and *C* put in 234*l.* and they find (when the make up their Accompts) that they have gained in, a 264*l.* now I deſire to know each Man's particular Share i the Gain?

Firſt, I add their particular Stocks together, and the Sum is 429*l.* then ſay, if 429*l.* gain 264*l.* what will 78*l.* gain? And what will 117*l.* and what will 234*l.* (the Stocks of *A, B* and *C*) gain? Work by three ſeveral Rules of Three, and you will find that

78
117
234
Sum 42

$$\text{The Gain of } \left\{\begin{matrix} A \\ B \\ C \end{matrix}\right\} \text{ is } \left\{\begin{matrix} 48 \\ 72 \\ 144 \end{matrix}\right.$$

Sum 264

Queſt. 3. Four Partners, *viz. A, B, C* and *D*, among them built a Ship, which coſt 1730*l.* of which *A* paid 346 *B* 519*l.* *C* 692*l.* and *D* 173*l.* and her Freight for a certai Voyage is 370*l.* which is due to the Owners or Builders; demand each Man's Share therein, according to his Charg in building her?

Anſwer, $\left\{\begin{matrix} A \\ B \\ C \\ D \end{matrix}\right.$ $\begin{matrix} 74 \\ 111 \\ 148 \\ 37 \end{matrix}$

370

Queſt. 4. *A, B* and *C* enter into Partnerſhip for a certai Time, *A* put into a common Stock 364*l.* *B* put in 482 *C* put in 500*l.* and they gained 867*l.* now I demand eac Man's Share in the Gain, proportionable to his Stock?

Anſwer,

	l.	*s.*	*d.*	
A	234	9	3	$\frac{354}{1346}$
B	310	9	5	$\frac{462}{1346}$
C	322	1	3	$\frac{930}{1346}$
Sum	867	0	0	

5. To prove the ſingle Rule of Fellowſhip, add eac Man's particular Gain or Loſs together, and if the total Sum is equal to the general Gain or Loſs, then is the Work rightly perſormed, but otherwiſe it is erro neous. *Example*; In the firſt Queſtion of this Chapter, th Anſwer was, That the Gain of *A* was 3*l.* and the Gain o *B* 2*l.* which added together makes 5*l.* equal to the tota Gain given.

The Proof of the Rul of Single Fellowſhip

If in finding out the particular Shares of the ſevera Partners

Partners, any Thing remain after Diviſion is ended, ſuch Remainders muſt be added together (they being all Fractions of the ſame Denomination) and their Sum divided by the common Diviſor in each Queſtion, *viz.* the total Stock, and the Quotient added to the particular Gains; and then if the total Sum is equal to the total Gain, the Work is right, otherwiſe not.

As in the 4th Queſtion, the Remainders were 354, 62 and 930, which added together make 1346, which divided by 1346 (the Sum of their Stocks) the Quotient is 1*d.* which I add to the Pence, *&c.* and the Sum of their Share is 897*l.* equal to the total Gain, wherefore I conclude the Work is right.

CHAP. XVI.

Double Fellowſhip.

DOuble Fellowſhip is, when ſeveral Perſons enter into Partnerſhip for unequal Time; that is, when every Man's particular Stock hath relation to a particular Time.

2. In the Double Rule of Fellowſhip, multiply each particular Stock by its reſpective Time, and having added the ſeveral Products together, make their Sum the firſt Number (or Term) in the *Rule of Three*, and the total Gain or Loſs the ſecond Number, and the Product of any one's particular Stock by his Time the third Term, and the fourth Number in proportion thereunto is his particular Gain or Loſs, whoſe Product of Stock and Time is your third Number.

Then repeat (as in *Single Fellowſhip*) the *Rule of Three*, as often as there are Products (or Partners) and the four Terms thereby invented, are the Numbers required.

Example.

Queſt. 1. *A* and *B* enter Partnerſhip; *A* put in 40*l.* for 3 Months, *B* put in 75*l.* for 4 Months, and they gained 70*l.* now I demand each Man's Share in the Gain, proportional to his Stock and Time? *Anſwer*, *A* 20*l.* *B* 50*l.*

To reſolve this Queſtion, I firſt multiply the Stock of *A*, (*viz.* 40*l.*) by its Time (3 Months) and the Product is 120; then I multiply the Stock of *B* by its Time, *viz.* 75*l.* by 4, and it produceth 300, which I add to the Product of *A*, his Stock and Time, and the Sum is 420. Then by the Rule of Three Direct I ſay, as 420 (the Sum of the Products) is to 70, (the total Gain) ſo is 120 (the Product of *A*, his Stock and Time) to 20*l.* (the Share of

	l.	*l.*
	40	75
	3	4
A	120	*B* 300
		120
	Sum	420

of *A* in the Gains.) Then I ſay again, as 420 is to 70, ſo is 300 (the Product of *B* his Stock and Time) to 50*l.* (the Share of *B* in the Gains: And that each is to have for his Share.

Queſt. 2. *A*, *B* and *C* make a Stock for 12 Months, *A* put in at firſt 364*l.* and 4 Months after that he put in 40*l.* *B* put in at firſt 408*l.* and at the End of the 7 Months he took out 86*l.* *C* put in at firſt 148*l.* and 3 Months after he put in 86*l.* more, and 5 Months after that he put in 100*l.* more, and at the End of 12 Months their Gain is found to be 1436*l.* I deſire to know each Man's Share in the Gains, according to his Stock and Time?

Firſt, I conſider that the whole Time of their Partnerſhip is 12 Months: Then I proceed to find out the ſeveral Products, or Stock and Time, as followeth:

A had at firſt 364*l.* for 4 Months, wherefore that Product is — — — —	1456
Then he put in 40*l.* which with the firſt Sum makes 404*l.* which continued the Remainder of the Time, *viz.* 8 Months, and that Product is	3232
The Sum of the Products of the Stock and Time of *A* is — — — —	4688
B had 408*l.* in 7 Months, whoſe Product is	2856
And then took out 80*l.* therefore he left in Stock 322*l.* which continued the reſt of the Time, *viz.* 5 Months, whoſe Product is — — —	1610
The Sum of the Products of the Stock and Time of *B* is — — — —	4466
C put in 148*l.* for 3 Months, whoſe Product being multiplied by 3, is — — —	444
Then he put in 86*l.* which added to the firſt, (*viz.* 148*l.*) makes 234*l.* which lay in Stock 5 Months, and their Product is — — —	1170
Then he put in 100*l.* more, ſo then he had in Stock 334*l.* which continued the Remainder of the Time, 4 Months, which multiplied together, produces — — — —	1336
The Sum of the Product of the Money and Time of *C* is — — — —	2950
B — — — — —	4466
A — — — — —	4688
The total Sum of all the Products is — —	12104

Then I ſay, as 12104 is to 1436 (the total Gain) ſo is 4688 to the Share of *A* in the total Gain, *&c.* go on as in the foregoing Examples, and you will find their Shares in the Gain to be as followeth, *viz.*

Anſwer,

Answer,

The Share of $\left\{\begin{matrix}A\\B\\C\end{matrix}\right\}$ is $\left\{\begin{matrix}556 & 03 & 6\\ 529 & 16 & 9\\ 349 & 19 & 8\end{matrix}\right.$ (6102, 14104, 5496, 12103, 416, 12104)

1436 00 0

Queſt. 3. Three Graſiers, *A*, *B* and *C*, take a Piece of Ground for 46*l.* 10*s.* in which *A* put 12 Oxen for 8 Months, *B* put in 16 Oxen for 5 Months, and *C* put 18 Oxen for 4 Months; now the Queſtion is, what each Man ſhall pay of the 46*l.* 10*s.* for his Share in that Charge?

Answer,

$\left\{\begin{matrix}A\\B\\C\end{matrix}\right\}$ ſhall pay $\left\{\begin{matrix}l. & s.\\ 18 & 00\\ 15 & 00\\ 13 & 10\end{matrix}\right.$

46 10

3. The Proof of this Rule is the ſame with that of Single Fellowſhip, laid down in the 5th Rule of the 15th Chapter; and note, that

If a Loſs be ſuſtained inſtead of a Gain among Partners, every Man's Share to be born in the Loſs, is to be found after the ſame Method as their Gain, whether their Stocks be for equal or unequal Time.

CHAP. XVII.

Alligation Medial.

1. THE Rule of Alligation is that Rule in plural Proportion, by which we reſolve Queſtions wherein is a Compoſition or Mixture of diverſe Simples, as alſo it is uſeful in Compoſition of Medicines, both for Quantity, Quality or Price: And its Species are two, *viz.* Medial and Alternate.

2. Alligation Medial is, when having the ſeveral Quantities and Prices of ſeveral Simples propounded, we diſcover the mean Price or Rate of any Quantity of the Mixture compounded of thoſe Simples, and the Proportion is,

As the Sum of the Simples to be mingled is to the total Value of all the Simples, ſo is any Part or Quantity of the Compoſition or Mixture to its mean Rate or Price.

Queſt. 1. A Farmer mingled 20 Buſhels of Wheat, at 5*s.* *per* Buſhel, and 36 Buſhels of Rye at 3*s.* *per* Buſhel, with 40 Buſhels of Barley at 2*s.* *per* Buſhel; now I deſire to know what one Buſhel of that Mixture is worth?

To reſolve this Queſtion, add together the given Quantities and their Value, which is 96 Buſhels, whoſe total Value is 14*l.* 8*s.* as appeareth by the Work following; for

Buſhels

Bushels			*l.*	*s.*
20 of Wheat,	at 5*s.* *per* Bushel,	is	5	0
36 of Rye,	at 3*s.* *per* Bushel,	is	5	8
40 of Barley,	at 2*s.* *per* Bushel,	is	4	0
The Sum of their given Quantities is 96, and their Value is			14	8

Then say, by the Rule of Three Direct, if 96 Bushels cost or is worth 14*l.* 8*s.* what is one Bushel worth?

Bush.	*l.*	*s.*	*Bush.*
96	14	8	1 Bushel
	20		
	288		

96) 288 (3*s.*

288

(0) *Facit* 3 *s.* *per* Bushel.

Queſt. 2. A Vintner mingled 15 Gallons of Canary at 8*s.* *per* Gallon, with 20 Gallons of Malaga at 7*s.* 6*d.* *per* Gallon, with 10 Gallons of Malaga at 6*s.* 4*d.* *per* Gallon, and 24 Gallons of White-wine at 4*s.* *per* Gallon, now I demand what a Gallon of this Mixture is worth? Work as in the laſt Queſtion, and you will find the Anſwer to be 6*s.* 2*d.* 2*qrs.* $\frac{46}{69}$.

Queſt. 3. A Grocer hath mingled 3C. of Sugar at 56*s.* *per* C. with 4C. of Sugar at 3*l.* 14*s.* 8*d.* *per* C. and with 6C. at 1*l.* 17*s.* 4*d.* *per* C. I deſire to know the Price of a C.wt. of that Mixture? *Anſwer* 2*l.* 13*s.* 1*d.* $\frac{7}{13}$.

3. The Proof of this Operation is by the Price of any Quantity of the Mixture, to find out the total Value of the whole Compoſition, and if it is equal to the total Value of the ſeveral Simples, the Work is right, otherwiſe not. (*The Proof of* Alligation Medial.) As in the firſt Example, the Anſwer to the Queſtion was that 3*s.* is the Price of 1 Buſhel; wherefore I ſay, by the Rule of Proportion, if 1 Buſhel be 3*s.* what is 96 Buſhels? *Anſwer* 14*l.* 8*s.* which is the total Value of the ſeveral Simples; wherefore the Work is right.

CHAP. XVIII.

Alligation Alternate.

1. ALligation Alternate is, when there are given the particular Prices of ſeveral Simples, and thereby we diſcover ſuch Quantities of thoſe Simples, as being mingled together, ſhall bear a certain Rate propounded.

2. When

2. When ſuch a Queſtion is ſtated, place the given Prices of the Simples one over the other, and the propounded Price of the Compoſition againſt them in ſuch Sort that it may repreſent a Root, and they as ſo many Branches ſpringing from it, as in the following Example.

Queſt. 1. A certain Farmer is deſirous to mix 20 Buſhels of Wheat at 5*s.* or 60*d. per* Buſhel, with Rye at 3*s.* or 36*d. per* Buſhel, and with Barley at 2*s.* or 24*d. per* Buſhel, and Oats at 1*s.* 6*d. per* Buſhel, and deſireth to mix ſuch a Quantity of Rye, Barley and Oats, with the 20 Buſhels of Wheat, as that the whole Compoſition may be worth 2*s.* 8*d.* or 32*d. per* Buſhel.

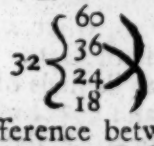
The Prices of the Simples being placed according to the laſt Rule (with the Price of the Compoſition propounded as a Root to them) will ſtand as followeth.

32 { 60 Pence
36
24
18

3. Having thus placed the given Numbers, you are to link the ſeveral Rates of the Simples one to the other, by certain Arches, in ſuch ſort that one that is leſſer than the mean Rate, may be coupled to another that is greater than the mean Rate; ſo the Queſtion laſt propounded will ſtand,

1. *Thus,*

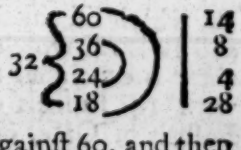
2. *Or thus,*



3. *Or thus,*

4. Then take the Difference between the Root and the ſeveral Branches, and place the Difference of each againſt the Number or Branch with which it is coupled or linked, and having taken all the Differences and placed them as aforeſaid, then thoſe Differences ſo placed will ſhew you the Number of each Simple to be taken to make a Compoſition to bear the mean Rate propounded.

So the Branches of the laſt Queſtion being linked together, as in the manner, I ſay, the Difference between 32 and 60 is 28, which I put againſt 18, becauſe 60 is linked with 18; then the Difference between 32 and 36 is 4, which I put againſt 24, becauſe 36 is linked or coupled with 24; then I ſay, the Difference between 32 and 24 is 8, which I place againſt 36 (for the Reaſon aforeſaid) then I ſay, the Difference between 32 and 18 is 14, which I place againſt 60, and then the Work will ſtand as you ſee in the Margent. So



So I conclude that a Compoſition made of 14 Buſhels of Wheat at 60*d. per* Buſhel, and 8 Buſhels of Rye at 36*d. per* Buſhel, and 4 Buſhels of Barley at 24*d. per* Buſhel, and 28 Buſhels of Oats at 18*d. per* Buſhel, will bear the mean Price of 32*d.* or 2*s.* 8*d. per* Buſhel. And here obſerve, that in the Compoſition there is but 14 Buſhels of Wheat, but I would mingle 20 Buſhels; and this Kind (or rather Caſe) of Alligation Alternate, *viz.* when there is given a certain Quantity of one of the Simples, and the Quantities of the reſt ſought to mingle with this given Quantity, that the Whole may bear a Price propounded) is called Alternation partial.

And the Proportion to find out the ſeveral Quantities to be mingled with the given Quantity, is thus,

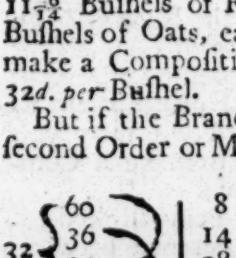
As the Difference annexed to the Branch, that is, the Value of an Integer of the given Quantity, is to the other particular Differences, ſo is the Quantity given to the ſeveral Quantities required.

So here, to find how much Rye, Barley and Oats muſt be mingled with the 20 Buſhels of Wheat, I ſay, by the Rule of Three Direct, if 14 Buſhels of Wheat require 8 Buſhels of Rye, what will 20 Buſhels of Wheat require? *Anſwer*, $11\frac{6}{7}$ Buſhels of Rye.

Again, if 14 Buſhels of Wheat require 4 Buſhels of Barley, what will 20 Buſhels of Wheat require? *Anſ.* $5\frac{10}{14}$ Buſhels of Barley. Again, I ſay, if 14 Buſhels of Wheat require 28 Buſhels of Oats, what will 20 Buſhels of Wheat require? *Anſ.* 40 Buſhels of Oats.

And now I ſay, that 20 Buſhels of Wheat mingled with $11\frac{6}{7}$ Buſhels of Rye, and $5\frac{10}{14}$ Buſhels of Barley, and 40 Buſhels of Oats, each bearing the rate as aforeſaid, will make a Compoſition, or Heap of Corn, that may yield 32*d. per* Buſhel.

But if the Branches had been coupled according to the ſecond Order or Manner, the Differences would have been thus placed, *viz.* the Difference between 33 and 60 is 28, which I ſet againſt 24, becauſe 60 is linked thereto; and the Difference between 32 and 36 is 4, which I ſet againſt 18; and the Difference between 32 and 24 is 18, which I ſet againſt 60; then the Difference between 32 and 18 is 14, which I ſet againſt his Yoke-fellow 36; and then I conclude, that if you mix'd 8 Buſhels of Wheat with 14 Buſhels of Rye, 28 Buſhels of Barley, and 4 Buſhels of Oats, each bearing the aforeſaid Prices, the whole



whole Mixture may be ſold for 32*d. per* Buſhel, as by the Work in the Margent.

You ſee by this Work we have found how many Buſhels of Rye, Barley and Oats ought to be mixed with 8 Buſhels of Wheat, and to find out how many of each ought to be mixed with 20 Buſhels of Wheat, I ſay, as 8 is to 14, ſo is 20 to 35 Buſhels of Rye. As 8 is to 28, ſo is 20 to 70 Buſhels of Barley, as 8 is to 4, ſo is 20 to 10 Buſhels of Oats; whereby I conclude, that if to 20 Buſhels of Wheat I put 35 Buſhels of Rye, 70 Buſhels of Barley, and 10 Buſhels of Oats, each bearing the aforeſaid Price *per* Buſhel, that then a Buſhel of this Mixture will be worth 32*d.* or 2*s.* 8*d.*

And if the Branches had been linked as you ſee in the 3d Place, where each Branch bigger than the Root is link'd to two that are leſſer than the Root, then in this Caſe you muſt have placed the ſeveral Differences between the Root and Branches againſt thoſe two with which each is coupled; as firſt, the Difference between 32 and 60 is 28, which I ſet againſt 24 and 18, becauſe it is coupled with them both;

then the Difference between 32 and 36 is 4, which I ſet likewiſe againſt 24 and 18, becauſe 36 is linked to them both; then the Difference between 32 and 24 is 8, which I put againſt 60 and 36, becauſe 24 is linked to them both, then the Difference between 32 and 18 is 14, which I put againſt 60 and 36, the Yoke-fellows of 18.

Laſtly, I draw a Line behind the Differences, and add the Differences which ſtand againſt each Branch, and put the Sum behind the ſaid Line againſt its proper Branch, as you ſee in the Margent.

And now by this Work I find that 22 Buſhels of Wheat mingled with 22 Buſhels of Rye, and 32 Buſhels of Barley, and 32 Buſhels of Oats, each bearing the ſaid Price, will make a Mixture bearing the mean Rate of 32*d. per* Buſhel.

And now to find how much of each of the reſt muſt be mingled with 20 Buſhels of Wheat, I ſay,

As 22 is to 22, ſo is 20 to 20 Buſhels of Rye. As 22 is to 32, ſo is 20 to $29\frac{2}{11}$ Buſhels of Barley. As 22 is to 32, ſo is 20 to $29\frac{2}{11}$ Buſhels of Oats.

Whereby you ſee the Queſtions of Alligation Alternate will admit of more true Anſwers than one; for we have found three ſeveral Anſwers to this firſt Queſtion.

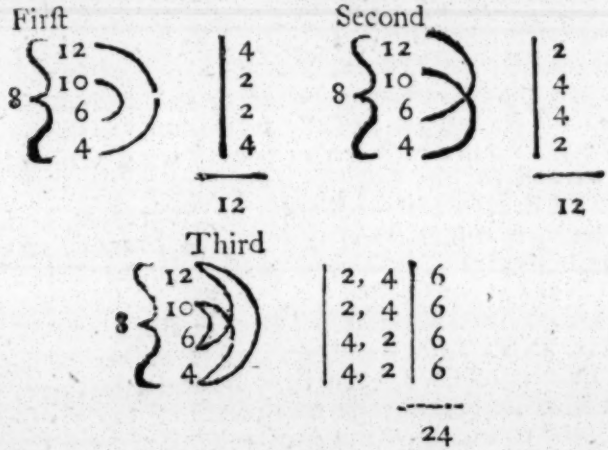
The Proof of Alligation partial.

Queſtions of Alligation partial are proved the ſame way with Queſtions in Alligation medial, which you may ſee in the 3d Rule of the 17th Chapter.

Queſt. 3. A Grocer hath 4 Sorts of Sugar, *viz.* of 12*d. per* lb, of 10*d. per* lb, of 6*d. per* lb, and of 4*d. per* lb, and would have a Compoſition worth 8*d. per* lb, the whole Quantity whereof ſhould contain 144lb made of theſe four Sorts? I demand how much of each he muſt take?

Queſtions of this Nature are reſolved by that Part of Alligation Alternate, called by Arithmeticians *Alligation Total*, *viz.* where there is given the Sum and Prices of ſeveral Simples, to find out how much of each Simple ought to be taken to make the ſaid Sum or Quantity, ſo that it may bear a certain Rate propounded.

To reſolve this Queſtion, I place the ſeveral Prices of the Simples and mean Rate propounded, and link them together, as is directed in the 2d and 3d Rules of this Chapter, and place the Differences between the Root and Branches, according to the 4th Rule of this Chapter, which will then ſtand one of theſe three Ways, *viz.*



5. Then add the ſeveral Differences together, which I have done, and the Sums of the firſt and ſecond Order are 12lb and of the third 24lb as you ſee above. But it required that there ſhould be 144lb of the Compoſition, therefore to find the Quantity of each Simple to make the whole Compoſition 144lb, obſerve this general Rule, *viz.*

As

As the Sum of the Differences is to the ſeveral Differences, ſo is the total Quantity of the Compoſition to the Quantity of each Simple.

So to find how much of each Sort of Sugar I ought to take to make 144lb at 8*d. per* lb.

As 12 is to 4, ſo is 144 to 48lb at 12*d. per* lb.
As 12 is to 2, ſo is 144 to 24lb at 10*d. per* lb.
As 12 is to 2, ſo is 144 to 24lb at 6*d. per* lb.
As 12 is to 4, ſo is 144 to 48lb at 4*d. per* lb.

Whereby I find that 48 lb. at 12*d. p r* lb, and 24lb at 10*d. per* lb, and 24lb at 6*d. per* lb, and 48lb at 4*d. per* lb, will make a Compoſition of Sugar containing 144lb worth 8*d. p r* lb.

But as the Branches are linked in the ſecond Order, the Anſwer will be 24lb at 12*d. per* lb, and 48lb at 10*d. per* lb, and 48lb at 6*d. per* lb and 24lb at 4*d. per* lb, to make the ſaid Quantity, and to bear the ſaid Price.

And if you had worked as the Branches are linked from the third Order, then you would have found the Quantity of 36lb of each.

Queſt. 3. A Vintner hath 4 Sorts of Wine, *viz.* Canary at 10*s. per* Gallon, Malaga at 8*s. per* Gallon, Rheniſh Wine at 6*s per* Gallon, and White Wine at 4*s. per* Gallon, and he is minded to make a Compoſition of them all of 60 Gallons, that they may be worth 5*s. per* Gallon, I deſire to know how much of each he muſt have?

The Number of Terms being ranked according to the ſecond Rule of this Chapter, the Branches will be linked as followeth, but will admit of no other manner of coupling, becauſe there is but one Branch that is leſſer than the Root, therefore all the reſt muſt be linked unto it; and the Differences between the Root and the three firſt Branches, *viz.* 10, 8 and 6, which are 5, and 3 and 1 muſt be ſet againſt 4 becauſe they are coupled with it; and the Difference between the Root, *viz.* 5 and 4, which is 1, muſt be ſet againſt the three other, becauſe it is linked to them all; ſo I find 1 Gallon of Canary, 1 Gallon of Malaga, 1 Gallon of Rheniſh Wine, and 9 Gallons of White Wine, priced as above, being mingled together,

5	10	1	1
	8	1	1
	6	1	1
	4	5, 3, 1	9

together, will be worth 5*s*. *per* Gallon, the Sum being 12 Gallons; but there muſt be 60 Gallons, wherefore I ſay,

As 12 is to 1, ſo is 60 to 5 Gallons of Canary.
As 12 is to 1, ſo is 60 to 5 Gallons of Malaga.
As 12 is to 1, ſo is 60 to 5 Gallons of Rheniſh.
As 12 is to 9, ſo is 60 to 45 Gallons of White Wine.

ſo that 5 Gallons of Canary, 5 Gallons of Malaga, 5 Gallons of Rheniſh, and 45 of White Wine mingled together, will be in all 60 Gallons worth 5*s*. *per* Gallon, which was required.

Queſt. 4. A Goldſmith hath Gold of four ſeveral Sorts of Fineneſs, *viz*. of 24 Carects fine, and of 22 Carects fine, and of 20 Carects fine, and of 15 Carects fine, (*Read Chap*. 2. *Def. of this Book*) and he would mingle ſo much of each with Alloy, that the whole Maſs of 28 *oz*. of Gold ſo mingled may bear 17 Carects fine; I demand how much of each he muſt take? The 2d and 3d Rules of this Chapter being obſerved, (for inſtead of the Alloy I put 0, becauſe it bears no Fineneſs, but it makes a Branch in the Operation) the Terms may be alligated, and the Differences added by any of theſe four Ways following, *viz*.

First thus,

Sum 56

Secondly thus,

Sum 56

Thirdly,

Thirdly thus,

17	24	3		2
	22	2		2
	20	2,	17	19
	15	7, 5, 3.		15
	0	3,		3

Sum 41

Fourthly thus,

17	24	2, 17,	19
	22	2, 17,	19
	20	2, 17,	19
	15	7, 5, 3,	15
	0	7, 5, 3,	15

Sum 87

More Ways may be given for the alligating or linking of the Terms in this Queſtion, but theſe, if well practiſed, are ſufficient for underſtanding the Rules of Alligation.

The Proof of Alternation Total.

In Queſtions of Alligation Total the Anſwer is given true, when the Sum of each of the Quantities of Simples found, agrees with the Sum or Quantity propounded; as in the laſt Queſtion, the Anſwer was 8*oz.* 10*pwt.* of 24 Carects fine, 10*oz.* of 22 Carects fine, 9*oz.* 10*pwt.* of 20 Carects fine, 4*oz.* of 25 Carects fine, and 5*oz.* of Alloy, which added together make 28*oz.* the Quantity propounded.

CHAP. XIX.

Reduction of Vulgar Fractions.

1. WHAT a Vulgar Fraction is, hath been already ſhewed in the 1ſt Chapter of this Book, to which I refer the Reader to look cautiouſly into.

2. To reduce a Vulgar Fraction, obſerve carefully theſe eight following Rules,

1. To reduce a mix'd Number into an improper Fraction.

2. To reduce a whole Number into an improper Fraction.

3. To reduce an improper Fraction into its equivalent whole (or mix'd) Number.

4. To

4. To reduce a Fraction into the loweſt Terms equivalent to the Fraction given.

6. To find the Value of a Fraction in the known Parts of Coin, Weight, Meaſure, *&c.*

7. To reduce a compound Fraction to a ſimple one of the ſame Value.

7. To reduce diverſe Fractions having unequal Denominations, to Fractions of the ſame Value having an unequal Denominator.

8. To reduce a Fraction of one Denomination to another of the ſame Value.

I. *To reduce a mix'd Number to an improper Fraction.*

The Rule is,

Multiply the Integer Part (or whole Number (by the Denominator of the Fraction, (*Vide Chap.* 1. *Defin.* 31.) and to the Product add the Numerator, and that Sum place over the Denominator for a new Numerator, ſo this new Fraction ſhall be equal to the mix'd Number given. As for Example:

1. Reduce $18\frac{3}{7}$ into an improper Fraction; multiply the whole Number 18 by 7 the Denominator, and to the Product add the Numerator 3, the Sum is 129, which put over the Denominator 7, and it makes $\frac{129}{7}$ for the Anſwer, as followeth.

$$18\frac{3}{7}$$
$$7$$
$$\text{Facit } \frac{129}{7}$$

2. Reduce $183\frac{5}{21}$ to an improper Fraction, *facit*, $\frac{3848}{21}$.

3. Reduce $50\frac{13}{22}$ to an improper Fraction, *facit*, $\frac{1113}{22}$.

II. *To reduce a whole Number into an improper Fraction.*

The Rule is, Multiply the given Number by the intended Denominator and place the Product for the Numerator over it. (*Vide Chap.* 1. *Defin.* 23.) As for Example:

1. Let it be required to reduce 15 into a Fraction whoſe Denominator ſhall be 12. To effect which, I multiply 15 by the intended Denominator (12) the Product is 180, which I place over 12 as a Numerator, and it makes $\frac{180}{12}$, which is equal to 15, as was required; as *per* Margent.

15	
12	
30	
Facit $\frac{180}{12}$	15
180	

2. Reduce

2. Reduce 36 into an improper Fraction, whoſe Denominator ſhall be 26, *facit* $^{9}\frac{36}{26}$.

3. Reduce 135 into an improper Fraction, whoſe Denominator ſhall be 16, *facit* $^{2}\frac{160}{16}$.

III. *To reduce an improper Fraction into its equivalent whole or mix'd Number.*

The Rule is, Divide the Numerator by the Denominator, and the Quotient is the whole Number equal to the Fraction; and if any Thing remain, put it for a Numerator over the Diviſor. *Example.*

1. Reduce $^{43}\frac{6}{8}$ into its equivalent mix'd Number. Divide the Numerator 436 by the Denominator 8, and the Quotient is 54, and 4 remains, which put for a Numerator over the Diviſor 8, the Anſwer is $54\frac{4}{8}$, as followeth.

8) 436 (54

40

36

32

(4)

Facit $54\frac{4}{8}$

2. Reduce $^{34}\frac{76}{15}$ to a mix'd Number. *Facit* $231\frac{11}{15}$.

3. Reduce $^{15}\frac{576}{138}$ to a mix'd Number. *Facit* $114\frac{72}{138}$.

IV. *To reduce a Fraction into its loweſt Terms, equivalent to the Fraction given.*

The Rule is, 1. If the Numerator and Denominator are even Numbers, take half the one and half of the other, as often as may be, and when either of them falls out to be an odd Number, then divide them by any Number that you can diſcover will divide both Numerator and Denominator without any Remainder; and when you have thus proceeded as low as you can reduce them, then this new Fraction ſo found out ſhall be the Fraction you deſire, and will be equal in Value to the given Fraction.

Example 1. Let it be required to reduce $\frac{192}{336}$ into its loweſt Terms. Firſt I take the half of the Numerator 192, and it is 96, then half of the Denominator, and it is 168, ſo that it is brought to $\frac{96}{168}$, and next to $\frac{48}{84}$, and by halfing ſtill to $\frac{24}{42}$, and their half is $\frac{12}{21}$, and now I can no longer half it, becauſe 21 is an odd Number, wherefore I try to divide them by 3, 4, 5, 6, *&c.* and I find 3 divides them both without any Remainder, and brings them to $\frac{4}{7}$, as *per* Margent.

192	96	48	24	12	4
336	168	84	42	21	7

So I conclude $\frac{4}{7}$ thus found to be equal in Value to the given Fraction $\frac{192}{336}$.

2. What is $\frac{1736}{1984}$ in its loweſt Terms? *Anſwer* $\frac{7}{8}$.

3. What is $\frac{1342}{1586}$ in its loweſt Terms? *Anſwer* $\frac{11}{13}$.

The beſt way to reduce a Fraction into its loweſt Terms is, by finding a common Meaſure, *viz.* the greateſt Number that will divide the Numerator and Denominator without any Remainder, and by that means reduce a Fraction to its loweſt Terms at the firſt Work; and to find out this common Meaſure, divide the Denominator by the Numerator, and if any Thing remain divide your Diviſor thereby, and if any Thing yet remain, then divide your laſt Diviſor by it; do ſo until you find nothing remaining; then this laſt Diviſor ſhall be your greateſt common Meaſure, which will divide both Numerator and Denominator, and reduce them both into their loweſt Terms at one Work.

Example 4. Reduce $\frac{228}{304}$ into its loweſt Terms by a common Meaſure; to effect which I divide the Denominator 304 by the Numerator 228, and there remains 76; then I divide 228 (the firſt Diviſor) by 76 (the Remainder) and it quotes 3, and nothing remains; wherefore the laſt Diviſor 76 is the common Meaſure, by which I divide the Numerator of the given Fraction; *viz.* 228, it quotes 3 for a new Numerator; then I divide the Denominator 304 by 76, and it quotes 4 for a new Denominator, ſo that now I have found $\frac{3}{4}$ equal to $\frac{228}{304}$.

5. Reduce $\frac{9048}{30072}$ into its loweſt Terms by a common Meaſure. *facit* $\frac{9}{11}$.

6. Reduce $\frac{30812}{203352}$ into its loweſt Terms by a common Meaſure. *facit* $\frac{13}{86}$.

A Compendium.

Note, That if the Numerator and Denominator of a Fraction end each with a Cypher or Cyphers, then cut off as many Cyphers from the one as from the other, and the remaining Figures will be a Fraction of the ſame Value, *viz.* $\frac{3400}{7100}$ will be found to be reduced to $\frac{34}{71}$, by cutting off the two Cyphers from the Numerator and Denominator with a Daſh of the Pen, thus, $\frac{34|00}{71|00}$, and $\frac{460}{700}$ will be $\frac{46}{70}$, thus, $\frac{46|0}{70|0}$, *&c.*

V. *To find the Value of a Fraction in the known Parts of Coin, Weights, &c.*

The Rule is, Multiply the Numerator by the Parts of the next inferior Denomination that are equal to an Unit of the

the ſame Denomination with the Fraction; then divide the Product by that Denominator, and the Quote gives you its Value in the ſame Parts you multiplied by, and if any Thing remain, multiply it by the Parts of the next inferior Denomination, and divide as before; do ſo till you can bring it no lower, and the ſeveral Quotients will give you the Value of the Fraction as was required; and if any at laſt remain, place it for a Numerator over the former Denominator. Some few Examples will make the Rule plain.

1. What is the Value of $\frac{27}{29}$ *l. ſterling?* To anſwer this Queſtion, I multiply the Numerator 27 by 20, (the Shillings in a Pound) the Product is 540, which I divide by 29 (the Denominator) and the Quotient is 18*s.* and there remains 18, which I multiply by 12 Pence, and the Product (216) I divide by the Denominator 29, the Quotient is 7*d.* and 13 remains, which I multiply by 4 Farthings, the Product is 52, which I ſtill divide by 29, the Quotient is 1 *qr.* and there remaineth 23, which I put for a Numerator over the Denominator 29, ſo I find the Value of $\frac{27}{29}$*l.* to be 18*s.* 7*d.* 1*qr.* $\frac{23}{29}$, as by the Work in the Margent, and after the ſame manner the Value of $\frac{11}{15}$ of a Pound *Sterling.* is found out to be 14*s.* 8*d.*

$\frac{27}{29}$ *l.*

27

Multiply 20

29) 540 (18*s.* 7*d.* $1\frac{23}{29}$ *q.*

29

250

232

Rem. (18)

Mult. 12

36

18

29) 216 (7*d.*

203

Rem. (13)

Mult. 4

---*qr.*

29) 52 (1 $\frac{23}{29}$

29

Rem. (23)

	s.	*d.*	*qr.*
Facit	18	7	$1\frac{23}{29}$

And ſo likewiſe you may find the Value of any Fraction either in Weight or Time, *&c.*

VI. *To reduce a compound Fraction to a Simple of the ſame Value.*

What a compound Fraction is, hath been ſhewn in *Chap.* 1. *Definition* 24, and to reduce it to a ſimple Fraction of the ſame Value.

The Rule is; Multiply the Numerators continually, and place the laſt Product for a new Numerator, then multiply

t e Denominators continually, and place the laſt Product for a new Denominator; ſo this ſingle Fraction ſhall be equal to the compound Fraction.

Example.

1. Reduce $\frac{2}{3}$ of $\frac{3}{5}$ of $\frac{5}{8}$ to a ſimple Fraction.

Multiply the Numerators, 2, 3 and 5 together, they make 30 for a new Numerator; then I multiply the Denominators 3, 5 and 8 together, and their Product is 120 for a Denominator, ſo the ſimple Fraction is $\frac{30}{120}$, and cutting off the Cyphers it is $\frac{3}{12}$, equal to the $\frac{1}{4}$ by the 4th Rule following.

5	3
3	2
15	6
8	5
120	30

Facit $\frac{30}{120}$, or $\frac{3}{12}$, or $\frac{1}{4}$.

2. What is $\frac{7}{10}$ of $\frac{5}{9}$ of $\frac{4}{7}$ of $\frac{11}{12}$? *Anſw.* $\frac{1540}{7560}$, or $\frac{154}{756}$, or $\frac{77}{378}$ in its loweſt Terms.

3. What is $\frac{11}{12}$ of $\frac{13}{14}$ of $\frac{21}{49}$? *Anſwer* $\frac{3003}{8232}$.

By this you may know how to find the Value of a compound Fraction, *viz.* firſt reduce it to a ſimple one, and then find out its Value by the 5th Rule foregoing.

Example 4. What is the Value of $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{9}{10}$ of a Pound *ſterl.*? *Anſwer* 11*s.* 3*d.*

VII. *To reduce Fractions of unequal Denominations to Fractions of the ſame Value, having equal Denominators.*

The Rule is, Multiply all the Denominators together, and the Product ſhall be the common Denominator; then multiply each Numerator into all the Denominators, except its own, and the laſt Product put for a Numerator over the Denominator found out as before; ſo this new Fraction is equal to that Fraction whoſe Numerator you multiply into the ſaid Denominator. Do ſo by all the Numerators given, and you have your Deſire.

Example.

1. Reduce $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{6}$ and $\frac{7}{8}$ to a common Denominator. Multiply the Denominators 4, 5, 6 and 8 together continually, and the Product is 960 for the common Denominator; then multiply the Numerator 3 into the Denominators, 5, 6 and 8, and the Product is 720, which is a Numerator to 960 (found as before) ſo $\frac{720}{960}$ is equal to the

firſt

first Fraction $\frac{3}{4}$; then I proceed to find a new Numerator to the second Fraction, *viz.* $\frac{4}{5}$, and I multiply 4 (into all the Denominators except its own, *viz.*) into 4, 6 and 8, which produceth $\frac{768}{960}$ equal to $\frac{4}{5}$, then multiply the Numerator 5 into the Denominators, 4, 5 and 8, the Product is $\frac{800}{960}$, equal to $\frac{5}{6}$, then multiply the Numerator 7 into the Denominators 4, 5 and 6, the Product is $\frac{840}{960}$, equal to $\frac{7}{8}$ and the Work is done: So that for $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{6}$ and $\frac{7}{8}$ I have $\frac{720}{960}$, $\frac{768}{960}$, $\frac{800}{960}$ and $\frac{840}{960}$.

2. Reduce $\frac{11}{12}$, $\frac{14}{3}$ and $\frac{19}{21}$ to a common Denominator, *faciant* $\frac{53}{57}\frac{3}{96}$, $\frac{35}{57}\frac{28}{96}$ and $\frac{52}{57}\frac{44}{96}$.

VIII *To reduce a Fraction of one Denomination to another.*

1. This is either ascending or descending. Ascending, when a Fraction of a smaller is brought to a greater Denomination. Descending when a Fraction of a greater Denomination is brought lower.

2. When a Fraction is to be brought from a lesser to a greater Denomination, hen make of it a compound Fraction, by comparing it with the intermediate Denominations between it, and that you would have it reduced to; then (by the 6th Rule foregoing) reduce your Compound to a simple Fraction, and the Work is done.

Example.

Quest. 1. It is requir'd to know what Part of a Pound *Sterling* $\frac{5}{7}$ of a Penny is?

To resolve this, I consider that 1*d.* is $\frac{1}{12}$ of a Shilling, and a Shilling is $\frac{1}{20}$ of a Pound; wherefore $\frac{5}{7}d.$ is $\frac{5}{7}$ of $\frac{1}{12}$ of $\frac{1}{20}$ of a Pound, which, by the said 6th Rule, I find to be $\frac{5}{1680}$ of a Pound *Sterl.* of *English* Money.

Quest. 2. What Part of a Pound *Troy-weight* is $\frac{4}{7}$ of a Penny-weight? *Answ.* $\frac{4}{7}$ of $\frac{1}{20}$ of $\frac{1}{12}$, equal to $\frac{4}{1200}$ *Troy.*

3. When a Fraction is to be brought from a greater to a lesser Denomination, then multiply the Numerator by the Parts contained in the several Denominations betwixt it and the Parts you would reduce it to; then place the last Product over the Denominator of the given Fraction.

Example.

Quest. 3. I would reduce $\frac{3}{5}l.$ to the Fraction of 1*d.* to do which, I multiply the Numerator 3 by 20 and 12, the Product is 720, which I put over the Denominator 5, it makes $\frac{720}{5}$ of 1*d.* equal to $\frac{3}{5}l.$

Quest. 4. What Part of an Ounce *Troy* is $\frac{5}{16}$ lb? *Answer* $\frac{60}{16}$ *oz.*

CHAP.

CHAP. XX.

Addition of Vulgar Fractions.

1. IF your Fractions to be added have a common Denominator, then add all the Numerators together, and place their Sum for a Numerator to the common Denominator, which new Fraction is the Sum of all the given Fractions; and if it be improper, reduce it to a whole or mix'd Number, by the 3d Rule in the 19th Chapter.

Queſt. 1. What is the Sum of $\frac{7}{24}$, $\frac{9}{24}$, $\frac{16}{24}$ and $\frac{14}{24}$?

The Denominators are equal, *viz.* every one is 24; wherefore add the Numerators together, *viz.* 7, 9, 16 and 14, their Sum is 46, which put over the Denominator 24, it makes $\frac{46}{24}$, the Sum of the given Fractions, which will be reduced to the mixed Numbers $1\frac{22}{24}$ or $1\frac{11}{12}$.

2. But if the Fractions to be added have unequal Denominators, then reduce them to a common Denominator by the 7th Rule of Chap. 19, and then add the Numerators together, and put the Sum over the common Denominator, *&c.* as before in the laſt Example.

Queſt. 2. What is the Sum of $\frac{3}{5}$, $\frac{7}{8}$, $\frac{9}{10}$ and $\frac{11}{12}$?

The Fractions reduced to a common Denomin or are $\frac{2880}{4800}$, $\frac{4200}{4800}$, $\frac{4320}{4800}$ and $\frac{4400}{4800}$, the Sum of their Numerators is 15800, which put over the common Denominator makes $\frac{15800}{4800}$, or $\frac{158}{48}$, equal to the mix'd Number $3\frac{14}{48}$ for the Sum required.

Queſt. 3. What is the Sum of $\frac{13}{17}$, $\frac{81}{45}$ and $\frac{36}{47}$?

Anſwer. $1\frac{37555}{35955}$.

3. If you are to add mix'd Numbers together, then add the fractional Parts as before, and if their Sum be an improper Fraction, reduce it to a mix'd Number, and add its integral Part to the integral Parts of the given mix'd Numbers, and the Work is done.

Queſt. 4. What is the Sum of $13\frac{3}{4}$ and $24\frac{5}{8}$?

Firſt add the Fractions $\frac{3}{4}$ and $\frac{5}{8}$: the Sum is $1\frac{1}{8}$, then add the Integer 1 to 13 and 24, their Sum is 38, and put after it the Fraction $\frac{1}{8}$, it is $38\frac{1}{8}$ for the Anſwer, or it is $38\frac{1}{8}$.

Queſt. 5. What is the Sum of $48\frac{3}{7}$, $64\frac{5}{8}$ and $130\frac{3}{4}$?

Facit $243\frac{180}{224}$, or $243\frac{45}{56}$.

4. If any of the Fractions to be added is a compound Fraction, it muſt firſt be reduced to a ſimple Fraction by the 6th Rule of Chapter 19, and then add it to the reſt, according to the 2d Rule of this Chapter.

Example.

Example.

Queſt. 6. What is the Sum of $\frac{3}{4}$, $\frac{5}{6}$ and $\frac{7}{8}$ of $\frac{3}{4}$ of $\frac{5}{6}$?

Reduce $\frac{7}{8}$ of $\frac{3}{4}$ of $\frac{5}{6}$ into a ſimple Fraction, and it is $\frac{105}{192}$, which reduced with the other two, and added, are $2\frac{600}{768}$.

Queſt. 7. What is the Sum of $\frac{11}{12}$ and $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{5}{6}$?

Anſwer $1\frac{5}{12}$.

5. If the Fractions to be added are not of one Denomination, they muſt be ſo reduced, and then proceed as before.

Queſt. 8. What is the Sum of $\frac{3}{4}$ *l.* and $\frac{5}{6}$ *s.*?

Of the given Fractions here, one is of a Pound, and the other the Fraction of a Shilling; and before you can add them together you muſt reduce $\frac{5}{6}$ *s.* to the Fraction of a Pound as the other is (by the 8th Rule of Chap. 19.) and it makes $\frac{5}{120}$ *l.* then $\frac{3}{4}$ and $\frac{5}{120}$ *l.* will be found to be $\frac{380}{480}$ *l.* or $\frac{38}{48}$ *l.* by the 7th Rule of Chap. 19. and in its loweſt Terms $\frac{19}{24}$ *l.* by the 4th Rule of Chap. 19.

It would have been the ſame (if by the latter Part of the 8th Rule of Chapter 19) you had reduced $\frac{3}{4}$ *l.* to the Fraction of a Shilling, which you would have found to have been $\frac{60}{4}$ *s.* which added to $\frac{5}{6}$ *s.* by the ſaid 17th Rule of the laſt Chapter, the Sum is 15 *s.* $\frac{20}{24}$, which is equal to the Sum found, as before, *viz.* $\frac{19}{24}$ *l.* for (by the 5th Rule of Chapter 19) the Value of $\frac{12}{24}$ *l.* will be found to be 15 *s.* 10 *d.* and ſo will 15 *s.* $\frac{20}{24}$ be found to be juſt as much.

Queſt. 9. What is the Sum of $\frac{2}{3}$ *l.* $\frac{3}{5}$ *s.* and $\frac{3}{5}$ *d.*?

Anſ. $\frac{2500500}{6000000}$ or $\frac{2505}{6000}$ *l.* or in its loweſt Terms $\frac{501}{1200}$.

CHAP. XXI.

Subtraction of Vulgar Fractions.

1. THE Rules in *Addition* for reducing the given Fractions to one Denomination, are here to be obſerved; for before Subtraction can be made, the Fractions muſt be reduced to a common Denominator; then ſubtract one Numerator from the other, and place the Remainder over a common Denominator, which Fraction ſhall be the Exceſs or Difference between the given Fractions.

Examples.

Queſt. 1. What is the Difference between $\frac{3}{4}$ and $\frac{5}{7}$? The given Fractions are reduced to $\frac{21}{28}$ and $\frac{20}{28}$, then ſubtract the

the Numerator 20 from the Numerator 21, and there remains 1, which being put over the Denominator 28 makes $\frac{1}{28}$ for the Answer or Difference between $\frac{3}{4}$ and $\frac{5}{7}$.

Queſt. 2. What is the Difference between $\frac{5}{7}$ and $\frac{3}{5}$ of $\frac{5}{8}$?

Reduce the compound Fraction $\frac{3}{5}$ of $\frac{5}{8}$ to a ſimple Fraction, then proceed as before, and the Anſwer is $\frac{11}{240}$, equal to $\frac{11}{24}$.

2. When a Fraction is given to be ſubtracted from a whole Number, ſubtract the Numerator from the Denominator, and put the Remainder for a Numerator to the given Denominator, and ſubtract an Unit (for that you borrowed) for the whole Number, and the Remainder place before the Fraction found, as before, which mixed Number is the Remainder or Difference ſought.

Example.

Queſt. 3. Subtract $\frac{7}{10}$ from 48.

Anſwer 47 $\frac{3}{10}$, for if you ſubtract 7 (the Numerator) from 10 (the Denominator) there remains 3, which put over 10 is $\frac{3}{10}$, and 1 (I borrowed) from 48 reſts 47, to which join $\frac{3}{10}$, and it makes 47 $\frac{3}{10}$ for the Exceſs.

Queſt 4. Subtract $\frac{13}{18}$ from 57, remain 56 $\frac{5}{18}$.

3. If it be required to ſubtract a Fraction from a mix'd Number, or one mix'd Number from another, reduce the Fraction to a common Denominator, and if the Fraction to be ſubtracted be leſſer than the other, then ſubtract the leſſer Numerator from the greater, and that is a Numerator for the common Denominator; then ſubtract the leſſer integral Part from the greater, and the Remainder, with the remaining Fractions thereunto annexed, is the Difference requir'd between the two given mix'd Numbers.

Queſt. 5 Subtract 26$\frac{3}{7}$ from 54$\frac{5}{6}$.

Firſt, ſubtract $\frac{3}{7}$, *viz.* $\frac{18}{42}$ from $\frac{5}{6}$, *viz.* $\frac{35}{42}$, the Remainder is $\frac{17}{42}$; then 26 from 54 remaineth 28, to which annex $\frac{18}{42}$, it makes 28 $\frac{18}{42}$ for the Anſwer.

4. But if the Fraction to be ſubtracted is greater than the Fraction from whence you ſubtract, then having firſt reduced the Fractions to a common Denominator, take the Numerator of the greateſt Fraction out of the Denominator, and add the Remainder to the Numerator of the leſſer Fraction, and their Sum is a new Numerator to the common Denominator, which Fraction note; then (for the 1 you borrowed) add 1 to the integral Part to be ſubtracted, and ſubtract it from the greater Number, and to the Remainder annex the Fraction you noted before, ſo this new mix'd Number ſhall be the Difference ſought.

Example.

Example.

Queſt. 6. Subtract $14\frac{3}{4}$ from $29\frac{4}{7}$.

The Fractions reduced are, *viz.* $\frac{3}{4}$ equal to $\frac{21}{28}$, and $\frac{4}{7}$ equal to $\frac{16}{28}$; now I ſhould ſubtract $\frac{21}{28}$, from $\frac{16}{28}$, but I cannot, therefore I ſubtract 21 from 28, reſt 7, which added to 16 (the leſſer Numerator) make 23 for a Numerator to 28, *viz.* $\frac{23}{28}$; then I come to the integral Parts 14 and 29. and ſay, 1 that and I borrowed and 14 is 15, which taken from 29 there reſts 14, to which annexing $\frac{23}{28}$, it is $14\frac{23}{28}$, for the Remainder or Difference between $14\frac{3}{4}$ and $29\frac{4}{7}$.

Queſt. 7. Subtract $36\frac{9}{10}$ from $74\frac{4}{9}$. *Facit* $37\frac{49}{90}$.

CHAP. XXII.

Multiplication of Vulgar Fractions.

1. IF the Multiplicand and Multiplier are ſimple Fractions then multiply the Numerators together for a new Numerator, and the Denominators for a new Denominator, and the new Fraction is the Product required.

Queſt. 1. What is the Product of $\frac{5}{7}$ by $\frac{9}{11}$? *facit* $\frac{45}{77}$; for the Numerators 5 and 9 being multiplied make 45, and the Denominators 7 and 11 being multiplied make 77.

Queſt. 2. What is the Product of $\frac{18}{25}$ by $\frac{21}{37}$? *facit* $\frac{378}{925}$.

2. If the Fractions to be multiplied be mix'd Numbers, reduce them to improper Fractions by the firſt Rule of the 19th Chapter, then proceed as before.

Queſt. 3. What is the Product of $48\frac{3}{5}$ by $13\frac{5}{6}$?

The given mix'd Numbers being reduced to improper Fractions are $48\frac{3}{5}$ equal to $\frac{243}{5}$, and $13\frac{5}{6}$ equal to $\frac{83}{6}$; now $\frac{243}{5}$ multiplied by $\frac{83}{6}$, according to the 1ſt Rule of this Chapter, produceth $\frac{20169}{30}$, or $672\frac{9}{30}$.

Queſt. 4. What is the Product of $439\frac{6}{10}$ by $18\frac{3}{7}$? *facit* $\frac{56708}{70}\frac{4}{}$ or $8104\frac{4}{10}$.

3. If a compound Fraction is to be multiplied by a ſimple Fraction, firſt reduce the compound Fraction into a ſimple Fraction, then multiply the one by the other, as is taught above.

Queſt. 5. What is the Product of $\frac{16}{21}$ by $\frac{3}{4}$ of $\frac{5}{7}$ of $\frac{4}{5}$?

The compound Fraction $\frac{3}{4}$ of $\frac{5}{7}$ of $\frac{4}{5}$ reduced is $\frac{60}{140}$ or $\frac{6}{14}$, which multiplied by $\frac{16}{21}$ produceth $\frac{96}{294}$, which in its loweſt Term is $\frac{16}{49}$ for the Anſwer.

And

And if the Multiplicand and Multiplier are both compound Fractions, reduce them both to simple ones, then multiply these few Fractions as before, so you have the Product.

Queſt. 6. What is the Product of $\frac{3}{4}$ of $\frac{2}{3}$ of $\frac{3}{5}$ by $\frac{1}{2}$?
Anſwer $\frac{18}{120}$, in its loweſt Term $\frac{3}{20}$.
Queſt. 7. What is the Product of $\frac{2}{3}$ of $\frac{3}{4}$ by $\frac{3}{5}$ of $\frac{5}{8}$?
Anſwer $\frac{60}{360}$, or $\frac{6}{36}$, or in its leaſt Term $\frac{1}{6}$.

4. If a Fraction be to be multiplied by a whole Number, put under the given whole Number an Unit for a Denominator, whereby it will be an improper Fraction, then multiply the Fractions as before.

Example.

Queſt. 8. What is the Product of 24 by $\frac{2}{3}$?
Anſwer $\frac{48}{3}$; for 24 by putting an Unit under it will be $\frac{24}{1}$, and $\frac{24}{1}$ by $\frac{2}{3}$ produceth $\frac{48}{3}$ or 16.
Queſt. 9. What is the Product of 36 by $\frac{9}{11}$?
Anſwer $\frac{324}{11}$, or $29\frac{5}{11}$.

CHAP. XXIII.

Diviſion of Vulgar Fractions.

1. IF the Dividend and Diviſor are both ſimple Fractions, then multiply the Numerator of the Dividend into the Denominator of the Diviſor, and the Product is a new Numerator, and multiply the Denominator of the Dividend into the Numerator of the Diviſor, and the Product is a new Denominator, which new Fraction thus found is the Quotient you deſire.

Example.

Queſt. 1. What is the Quotient of $\frac{5}{8}$ divided by $\frac{3}{5}$?
Anſ. $\frac{25}{24}$, or $1\frac{1}{24}$; for firſt I multiply (5) the Numerator of the Dividend into (5) the Denominator of the Diviſor, and the Product (25) is a Numerator for the Quotient, then I multiply (8) the Denominator of the Dividend into (3) the Numerator of the Diviſor, and the Product (24) I put in the Quotient for a Denominator; ſo I find $\frac{25}{24}$ is the Quotient ſought.

$$\begin{matrix} 3 \\ --- \\ 5 \end{matrix} \Big) \begin{matrix} 5 \\ --- \\ 24 \end{matrix} \Big(\begin{matrix} 25 \\ --- \\ 24 \end{matrix}$$

Queſt.

Queſt. 2. What is the Quotient of $\frac{10}{21}$ divided by $\frac{2}{3}$?

Anſwer $\frac{30}{42}$, equal to $\frac{5}{7}$ in its loweſt Terms.

2. But if you will divide a ſimple Fraction by a Compound, or a Compound by a Simple, firſt reduce ſuch Compound to a ſimple Fraction, then go on as before.

Queſt. 3. What is the Quotient of $\frac{3}{10}$ divided by $\frac{3}{4}$ of $\frac{2}{3}$?

Anſwer $\frac{36}{60}$ or $\frac{2}{5}$; firſt reduce $\frac{3}{4}$ of $\frac{2}{3}$ into a ſimple Fraction, and it is $\frac{6}{12}$, by which $\frac{3}{10}$ being divided, the Quotient is $\frac{36}{60}$, equal in its leaſt Terms to $\frac{6}{10}$; and if the Dividend and Diviſor be both of compound Fractions, reduce them both to a ſimple Fraction, then divide the one by the other, as in Rule 1. foregoing.

Queſt. 4. What is the Quote of $\frac{2}{3}$ of $\frac{3}{4}$ divided by $\frac{2}{5}$ of $\frac{5}{6}$?

Anſwer $\frac{180}{120}$ or $\frac{18}{12}$, or $1\frac{8}{16}$, or $1\frac{1}{2}$ in its loweſt Terms.

3. If the Dividend, or Diviſor, or both, are mixed Numbers, reduce them to improper Fractions, and perform Diviſion as you are taught before.

Queſt. 5. What is the Quote of $12\frac{3}{4}$ divided by $21\frac{4}{5}$?

Anſwer $\frac{255}{438}$ for $12\frac{3}{4}$, is equal to $\frac{51}{4}$, and $21\frac{4}{5}$ is equal to $\frac{109}{5}$, and the Quote of $\frac{51}{4}$ divided by $\frac{109}{5}$ is as before $\frac{255}{438}$.

4. If you divide a Fraction by a whole Number, or a whole Number by a Fraction, make the whole Number an improper Fraction, by putting an Unit for a Denominator to it, as was taught in Rule 4. Chap. 22. and then perform Diviſion as was before taught.

Example.

Queſt. 6. What is the Quote of 8 divided by $\frac{3}{5}$?

Anſwer $\frac{40}{3}$, which is equal to $13\frac{1}{3}$, being reduced as is before directed. See the Work in the Margent.

$$\begin{array}{r|l} 3 & 8 \\ \hline 5 & 1 \end{array} \quad \left(40 \text{ or } 13\tfrac{1}{3}\right.$$

Queſt. 7. What is the Quotient of $\frac{3}{5}$ divided by 8?

Anſwer $\frac{3}{40}$, as *per* Margent.

$$\begin{array}{r|l} 8 & 3 \\ \hline 1 & 5 \end{array} \quad \left(\begin{array}{l} 3 \\ \hline 40 \end{array}\right.$$

CHAP. XXIV.

The Rule of Three Direct in Vulgar Fractions.

1. AS in the Rule of Three in whole Numbers, ſo likewiſe in Fractions, you muſt ſee that the Fractions of the firſt and third Places be of the ſame Denomination.

2. If any of the given Fractions be compound, let 'em be reduced to ſimple of the ſame Value.

3. If there are given mixed Numbers, reduce them to improper Fractions by the firſt Rule of Chap. 19.

4. If

4. If any of the three Terms is a whole Number, make it an improper Fraction, by conſtituting an Unit for its Denominator.

Having reduced your Fraction as is directed in the four laſt Rules, then proceed to a Reſolution, which is performed the ſame way as in whole Numbers, Reſpect being had to the Rule delivered for the working of Fractions, *viz.* Multiply the 2d and 3d Fractions together, according to the firſt Rule of Chap. 22. and divide the Product by the firſt Fraction, according to the firſt Rule of Chap. 23. and the Quotient is the Anſwer.

Or, (which is better)

5. Multiply the Numerator of the firſt Fraction into the Denominator of the ſecond and third, and the Product is a new Denominator; then multiply the Denominator of the firſt Fraction into the Numerator of the ſecond and third, and the Product is a new Numerator, which new Fraction is the fourth Proportional or Anſwer, which (if it be an improper Fraction) muſt be reduced to a whole or mix'd Number by the 3d Rule of Chap. 19.

Example.

Queſt. 1. If $\frac{3}{4}$ Yards of Cloth coſt $\frac{5}{8}$ *l.* what will $\frac{9}{10}$ Yards coſt?

Having placed the given Fractions according to the 6th Rule of Chap. 10. I proceed to the Reſolution, and firſt I multiply the Numerator of the firſt Fraction (3) into 8 and 10, the Denominators of the ſecond and third Fractions, and the Product is 240 for a Denominator; then multiply 4 the Denominator of the firſt Fraction into 5 and 9, the Numerators of the ſecond and third Fractions, the Product is 180 for a Numerator, which Numerator 180 and Denominator 240 make $\frac{180}{240}$ *l.* for the Anſwer, equal to $\frac{3}{4}$ or 15*s.*

Yards	*l.*	*Yards*	*l.*
3	5	9	180
4	8	10	240

l.
180
Facit 240 equal to $\frac{3}{4}$

Queſt. 2. If $\frac{2}{3}$ *l.* buy $\frac{5}{6}$ Yards of Cloth, what will $\frac{11}{12}$ Yards coſt at that Rate?

Anſwer $\frac{132}{150}$ *l.* equal to $\frac{11}{15}$ *l.* or 14*s.* 8*d.*

Queſt. 3. If $\frac{7}{8}$ *l.* coſt $\frac{3}{4}$ *s.* what will $\frac{8}{9}$. buy?

Anſwer $\frac{224}{216}$ *l.* equal to $1\frac{1}{27}$ *l.*

Queſt. 4. If $\frac{3}{5}$ of an Ell of Holland coſt $\frac{1}{3}$ *l.* how much will $12\frac{2}{3}$ Ells coſt at that Rate?

Anſwer $\frac{120}{27}$, equal to $7\frac{1}{27}$ *l.*

In

In reſolving the laſt Queſtion and the two next, obſerve the 3d Rule of the Chapter foregoing.

Queſt. 5. If $\frac{9}{10}$ of a *C.* coſt 284*s.* what will $7\frac{1}{2}$*C.* coſt at that Rate?

Anſwer $2366\frac{2}{3}$*s.* or 118*l.* 6*s.* 8*d.*

Queſt. 6. If $3\frac{1}{4}$ Yards of Velvet coſt $3\frac{5}{8}$*l.* how much will $10\frac{1}{2}$ Yards coſt at that Rate?

Anſwer $11\frac{3}{52}$*l.*

Queſt. 7. If 3 Yards of Broad-cloth coſt $2\frac{4}{6}$*l.* what will $14\frac{3}{7}$ Yards coſt?

Anſwer 13*l.* 9*s.* 4*d.*

In working the laſt Queſtion and the four next, obſerve the 4th Rule of the Chapter foregoing.

Queſt. 8. If 14lb of Pepper coſt 14*s.* $6\frac{3}{5}$*d.* I demand the Price of $73\frac{3}{4}$lb?

Anſwer 3*l.* 16*s.* $7\frac{43}{56}$*d.*

Queſt. 9. If 1lb of Cochineel coſt 1*l.* 5*s.* what will $36\frac{7}{10}$lb coſt?

Anſwer 45*l.* 17*s.* 6*d.*

Queſt. 10. If 1 Yard of Broad-cloth coſt $15\frac{5}{8}$*s.* what will 4 Pieces, each containing $27\frac{3}{7}$ Yards coſt at that Rate?

Anſwer 85*l.* 14*s.* $3\frac{3}{7}$*d.*

Queſt. 11. A Mercer bought $3\frac{1}{2}$ Pieces of Silk, each Piece contained $24\frac{2}{3}$ Ells, at 6*s.* $0\frac{3}{4}$*d. per* Ell, I demand the Value of $3\frac{1}{2}$ Pieces at that Rate?

Anſwer 26*l.* 3*s.* $4\frac{3}{4}$*d.*

In reſolving the four next Queſtions, obſerve the 8th Rule of Chap. 19.

Queſt. 12. If $\frac{2}{5}$ of an Ounce of Silver coſt 2*s.* I demand the Price of $11\frac{2}{3}$ at that Rate?

Anſwer 35*l.*

Queſt. 13. If $5\frac{5}{7}$lb of Gold is worth 205*l.* 14*s.* $3\frac{3}{7}$*d. Sterling*, what is a Grain worth at that Rate?

Anſwer $1\frac{1}{2}$*d*

Queſt. 14. If $\frac{3}{4}$ Yards of Silk is worth $\frac{3}{4}$ of $\frac{5}{6}$*l.* what is the Price of $15\frac{8}{5}$*l* Ells Flemiſh?

Anſwer 9*l.* 7*s.* 6*d.*

Queſt. 15. If $\frac{2}{3}$ of $\frac{3}{4}$ of a Pound of Cloves coſt 6*s.* $2\frac{2}{7}$*d.* what coſt the C. weight at that Rate?

Anſwer 69*l.* 6*s.* 8*d.*

Note, That when the Anſwer to the Queſtions in this and the next Chapter are given in Fractions, they are given in their loweſt Terms.

CHAP.

CHAP. XXV.

The Rule of Three Inverſe in Fractions.

1. IT hath been already taught (in the 3d Rule of the 11th Chapter, how to diſcover when the 4th Proportional Number (to the 3 given Numbers) is to be found out by a *Rule of Three Direct*, and when by a *Rule of Three Inverſe*, to which Rule the Learner is now referred.

2. When (in Fractions) you find a Queſtion to be reſolv'd by the *Rule of Three Inverſe, viz.* when the third Term is the Diviſor, then having reduced the Terms exactly (according to the Rules in Chap. 24.) multiply the Numerators of the third Fraction into the Denominators of the ſecond and firſt Fractions, and the Product is a new Denominator; then multiply the Denominator of the third Fraction into the Numerators of the ſecond and firſt Fractions, and the Product is a new Numerator, which new Fraction thus found is the Anſwer to the Queſtion.

Queſt. 1. If $\frac{3}{4}$ of a Yard of Cloth, that is two Yards wide, will make a Garment, how much of any other Drapery that is $\frac{3}{5}$ of a Yard wide will make the ſame Garment?

Anſwer $2\frac{1}{2}$ Yards.

Queſt. 2. I lent my Friend 46*l.* for $\frac{4}{5}$ of a Year, how much ought he to lend me for $1\frac{7}{12}$ Parts of a Year?

Anſwer $63\ \frac{3}{7}$*l.*

Queſt. 3. If $\frac{1}{3}$ of a Yard of Cloth that is $2\frac{1}{3}$ Yards wide will make any Garment, what Breadth is that Cloth when $1\frac{3}{4}$ Yard will make the ſame Garment?

Anſwer $\frac{5}{6}\frac{6}{3}$ or $\frac{8}{6}$ of a Yard wide?

Queſt. 5. How many Inches in Length of a Board that is 9 Inches broad will make a Foot ſquare?

Anſwer 16 Inches in Length.

Queſt. 5. If when the Buſhel of Wheat coſt $4\frac{3}{4}$*s.* the Penny Loaf weighed $10\frac{2}{5}$ Ounces, what will it weigh when the Buſhel coſt $8\ \frac{8}{12}$*s.*?

Anſwer $5\ \frac{1}{2}\frac{8}{5}\frac{4}{4}$ Ounces.

Queſt. 6. If 17 Men can mow $24\frac{1}{2}$ Acres in $10\frac{2}{3}$ Days, in how many Days will 6 Men do the ſame?

Anſwer in $21\frac{1}{3}$ Days.

CHAP.

CHAP. XXVI.

Rules of Practice.

1. IN the ſingle Rule of Three, when the firſt of the three Numbers in the Queſtion (after they are diſpoſed according to the 6th Rule of Chap. 10.) happeneth to be an Unit (or 1.) that Queſtion many times may be reſolved far more ſpeedily than by the Rule of Three, which kind of Operation is commonly called *Practice*; and indeed it is of excellent Uſe among Merchants, Tradeſmen and others, by reaſon of its ſpeedineſs in finding a Reſolution to ſuch kind of Queſtions.

2. The chiefeſt Queſtions reſolvable by theſe brief Rules, may be comprehended under the three general Heads or Caſes following, *viz.*

When the given Price of the Integer conſiſts
1. Of Farthings under 4.
2. Of Pence under 12.
3. Of Pence and Farthings.
4. Of Shillings under 20.
5. Of Shillings, Pence and Farthings.
6. Of Pounds.
7. Of Pounds, Shillings, Pence & Farthings.

It would be very convenient for the practical Arithmetician to have by Heart the ſeveral Products of the nine Digits multiplied by 12, for his ſpeedy reducing Pence into Shillings, and Shillings into Pence, which he may gain by the following Table.

12 Times	1	12
	2	24
	3	36
	4	48
is	5	60
	6	72
	7	84
	8	96
	9	108

3. Shillings are practically reduced into Pounds thus, *viz.* cut off the Figure ſtanding in the Place of Units with a Daſh of the Pen, and note it for Shillings, then draw a Line under the given Number, and take half the remaining Figures (after the firſt is cut off and ſet them under the Line, and they are ſo many Pounds; but if the laſt Figure is odd, then take the leſſer half, and add 10 to the Figure

43658	
l.	*s.*
2182	18

Figure ſo cut off (as before) for Shillings; as if I were to reduce 43658 Shillings into Pounds, firſt I cut off the laſt Figure 8 for Shillings, then I take half of the remaining Figures (4365) thus, half of 4 is 2, which I put under the Line, then half of 3 is 1, and becauſe 3 is an odd Number, I make the next Figure 6 to be 16, and I go on, ſaying, half of 16 is 8, then half of 5 is 2, which is the laſt Figure, wherefore, becauſe 5 is an odd Number, I add 10 to the 8 I cut off, and it makes 18*s.* ſo that I find it to be 2182*l.* 18*s.* as *per* Margent.

4. It is likewiſe convenient that the Learner be acquainted with the practical Tables following, the firſt containing the aliquot or even Parts of a Shilling, the ſecond containing the even Parts of a Pound.

The even Part of a Shilling		is	
	6		$\frac{1}{2}$
	4		$\frac{1}{3}$
	3		$\frac{1}{4}$
	2		$\frac{1}{6}$
	$1\frac{1}{2}$		$\frac{1}{8}$
	1		$\frac{1}{12}$

The even Parts of a Pound.			*l.*
	10	00	$\frac{1}{2}$
	6	08	$\frac{1}{3}$
	5	00	$\frac{1}{4}$
	4	00	$\frac{1}{5}$
	3	04	$\frac{1}{6}$
	2	06	$\frac{1}{8}$
	2	00	$\frac{1}{10}$
	1	08	$\frac{1}{12}$
	1	00	$\frac{1}{20}$

is

Caſe.

5. When the Price of an Integer is a Farthing, then take the 6th Part of the given Number, which will be ſo many Three-half-pences, and if any Thing remain it is Farthings, by the 7th Rule of Chap. 9. then conſider, That Three-half-pence is $\frac{1}{8}$ of a Shilling, wherefore take the 8th Part of them for Shillings, (and if any Thing remain, they are ſo many Three-half-pences,) which reduce into Pounds by the 3d Rule foregoing.

Example.

What comes 67486lb to at a Farthing *per* lb? Firſt, I take $\frac{1}{6}$ of 67486, and it is 11247 Three-half-pences, and 4 Farthings or 1 Penny; then $\frac{1}{8}$ of 11247 is 1405*s.* and 7 remains, which is 7 Three-half-pences, or 10$\frac{1}{2}$*d.* which with the 4 Farthings before, make 11$\frac{1}{2}$*d.* and 1405*s.* which by the 3d Rule is 70*l.* 5*s.* in all 70*l.* 5*s.* 11$\frac{1}{2}$*d.* for the Anſwer. See the Work following.

67486

$\frac{1}{2}$	67486 at $\frac{1}{4}$ *per* lb	
		d.
$\frac{1}{8}$	11247	1
$\frac{1}{20}$	1405	$11\frac{1}{2}$
	l. *s.*	*d.*
	70 5	$11\frac{1}{2}$ *facit*

Other Examples follow.

$\frac{1}{2}$	8576lb at 1*qr.*	
$\frac{1}{8}$	1429	2*qrs.*
$\frac{1}{20}$	17|8	8*d.*
	l. *s.*	*d.*
	8 18	8

$\frac{1}{2}$	6380lb at 1*qr.*	
$\frac{1}{8}$	1063	2*qrs.*
$\frac{1}{20}$	13|2	11*d.*
	l. *s.*	*d.*
	6 12	11 *facit*

6. When the Price of the Integer is two Farthings, then take the third Part of the given Number for so many Three-half-pences, and the Remainder, if any, is Half-pence, then take the eighth Part of that for Shillings, as before, *&c.*

Example.

$\frac{1}{3}$	7368lb at 2*qrs.*	
$\frac{1}{8}$	2456	
$\frac{1}{20}$	30|7	
	l. *s.*	
	15 7	

$\frac{1}{3}$	8347lb at 2*qrs.*	
$\frac{1}{8}$	2782	2*qrs.*
$\frac{1}{20}$	34|7	9*d.* $\frac{1}{2}$
	l. *s.*	*d.*
	17 7	$9\frac{1}{2}$ *facit*

7. When the Price of the Integer is 3 Farthings, then take half the given Number for Three-half-pence, and if any Thing remain it is 3 Farthings; then take the 8th for Shillings, as before, *&c.*

$\frac{1}{2}$	4736lb at 3*qrs.*	
$\frac{1}{8}$	2368	
$\frac{1}{20}$	29|6	
	l. *s.* *d.*	
	14 16 *facit*	

$\frac{1}{2}$	5425lb at 3*qrs.*	
$\frac{1}{8}$	2712	6*d.*
$\frac{1}{20}$	339	3*qrs.*
	l. *s.*	*d. qrs.*
	16 19	0 3 *facit*

Case 2.

8. When the given Price of the Integer is a Part or Parts of a Shilling, (*viz.* Pence) divide the given Number of Integers (whose Value is sought) by the Denominator of the Fraction, representing the even Part, and the Quote is Shillings (always minding the 7th Rule of the 9th Chapter) and those Shillings may be reduced into Pounds by the 3d Rule of

of this Chapter: *Example.* Let it be required to find the Value of 438 lb at 3*d. per* lb I conſider 3*d.* is $\frac{1}{4}$ of a Shilling, and 438 lb will coſt ſo many 3 Pences, wherefore I divide 438 by 4, the Denominator of $\frac{1}{4}$, ann the Quote is 109 Shillings, and 2 remains, which is two 3*d.* or 6*d.* the whole Value is 5*l.* 9*s.* 6*d.* as by the following Work appeareth.

$\frac{1}{4}$	438 *l.* at 3 *d.*			*l.*	*s.*	*d.*
$\frac{1}{20}$	10|2------6		*Facit*	5	9	6

More Examples follow.

	l.	*d.*		*l.*	*d.*
$\frac{1}{2}$	3574 at 6 *per* l.		$\frac{1}{2}$	5316 at 2 *per* l.	
$\frac{1}{20}$	178|7		$\frac{1}{20}$	886	
	89*l.* 7*s. facit*			44*l.* 6*s. facit*	
	l.	*d.*		*l.*	*d.*
$\frac{1}{3}$	438 at 4 *per l.*		$\frac{1}{8}$	6389 at $1\frac{1}{2}$ *per* l.	
$\frac{1}{20}$	14|6		$\frac{1}{20}$	79|8 7*d.* $\frac{3}{4}$	
	7*l.* 6*s. facit*			39*l.* 18*s.* 7*d.* $\frac{3}{4}$	
	l.	*d.*		*l.*	*d.*
$\frac{1}{4}$	879 at 3 *per* l.		$\frac{1}{12}$	818 at 1 *per* l.	
$\frac{1}{20}$	219 9*d.*		$\frac{1}{20}$	68 2	
	10*l.* 19*s.* 9*d.*			3*l.* 8*s.* 2*d. facit*	

If the Learner is minded to try the Fruitfulneſs of his Genius, he may frame as many Examples as he thinks fit, and work them as before.

9. If the Price of the Integer be Pence under 12, and yet not an even Part, then it may be divided into even Parts, and ſo the Parts of the given Numbers taken accordingly and added together; as if it were 5*d.* which is 3*d.* and 2*d. viz.* $\frac{1}{4}$ and $\frac{1}{6}$ of a Shilling, firſt take $\frac{1}{4}$ of the given Number, and then $\frac{1}{6}$ thereof, and add them together, and their Sum is the Anſwer in Shillings: ſtill obſerving Rule 7 of Chap. 9. for the Remainder, (if any be) then bring the Shillings into Pounds, by the 3d Rule foregoing. Likewiſe 7*d.* is $\frac{1}{3}$ and $\frac{1}{4}$, ſo 9*d.* is $\frac{1}{3}$ and $\frac{1}{4}$, and 10*d.* is $\frac{1}{3}$ and $\frac{1}{4}$, and 11*d.* is $\frac{1}{3}$ and $\frac{1}{3}$ and $\frac{1}{4}$ of a Shilling; or elſe many Times your Work may be ſhortened thus, *viz.* when the ſaid given Price is to be divided into even Parts of a Shilling, or of a Pound, after you have taken the firſt even Part, the other may be an even Part of that Part, as in the next Example, where is given 439 lb at 5*d. per* lb now I may divide

divide it thus, *viz.* into 4*d.* and 1*d.* and 4*d.* being $\frac{1}{3}$ of a Shilling, and 1*d.* being $\frac{1}{4}$ of 4*d.* I firſt take $\frac{1}{3}$ of 439*l.* and it gives 146*s.* 4*d.* and for the 1*d.* I take $\frac{1}{4}$ of 146*s.* 4*d.* which is 36*s.* 7*d.* which in all come to 9*l.* 2*s.* 11*d.* Examples follow.

	l.	*d.*
	439 at 5 *per* l.	
$\frac{1}{3}$	146	4
$\frac{1}{4}$	36	7
	18|2	11

9*l.* 2*s.* 11*d.* *facit*

	Ells	*d.*
	587 at 7*d.* *per* Ell	
$\frac{1}{3}$	195	8
$\frac{1}{4}$	146	9
	34|2	5

17*l.* 2*s.* 5*d.* *facit*

	yds.	*d.*
	836 at 8 *per* yd.	
$\frac{1}{3}$	278	8
$\frac{1}{3}$	278	8
$\frac{1}{3}$	55|7	4

27*l.* 17*s.* 4*d.* *facit*

	yds.	*d.*
	417 at 9 *per* yd.	
$\frac{1}{2}$	208	6
$\frac{1}{2}$	104	3
$\frac{1}{10}$	31|2	9

15*l.* 12*s.* 9*d.* *facit*

	Ells	*d.*
	386 at 10	
$\frac{1}{2}$	193	
$\frac{1}{3}$	128	8
	32|1	8

16*l.* 1*s.* 8*d.* *facit*

	l.	*d.*
	534 at 11	
$\frac{1}{3}$	178	
$\frac{1}{3}$	178	
$\frac{1}{4}$	133	6
	48|9	6

24*l.* 9*s.* 6*d.* *facit*

10. When the Price of the Integer is Pence and Farthings, if it make an even Part of a Shilling, work as before; but if they are uneven, as Penny Farthing, Penny three Farthings, 2*d.* 1*qr.* or 2*d.* 3*qrs.* 3*d.* 3*qrs.* or the like, then firſt work for ſome even Part, and then conſider what Part the reſt is of that even Part, and divide that Quotient thereby, then add them together, and reduce them to Pounds as before. *Example.* 3470*lb* at 1*d.* 1*qr.* *per lb*; firſt I work for the Penny by dividing 3470*lb* by 12, for 1*d.* is $\frac{1}{12}$ of a Shilling, and the Quote is 289*s.* 2*d.* then I conceive that one Farthing is the $\frac{1}{4}$ of a Penny, and the Value at one Farthing will be $\frac{1}{4}$ of the Value at a Penny, and therefore I take $\frac{1}{4}$ of 289*s.* 2*d.* which is 72*s.* 3*d.* 2*qrs.* and add them together, and they are 18*l.* 1*s.* 5*d.* 2*qrs.* as by the Margent.

	l.	*d.*	*qrs.*
$\frac{1}{12}$	3470 at 1	1	
$\frac{1}{4}$	289	2	
	72	3	2
$\frac{1}{20}$	36|1	5	2
	l.	*s.*	*d.* *qrs.*
	18	1	5 2

	l.	*d.*
$\frac{1}{12}$	4360 at $1\frac{5}{4}$	
$\frac{1}{4}$	363	4
	90	10
	45|4	2
	22*l.* 14*s.* 2*d. facit*	

	485*l.* at $2\frac{1}{2}$*l.*	
$\frac{1}{8}$	80	10*d.*
	10	$1\frac{1}{4}$
	90	$11\frac{1}{4}$
	4*l.* 10*s.* $11\frac{1}{4}$*l. facit*	

$\frac{1}{6}$	654*l.* at $2\frac{1}{4}$*d.*	
$\frac{1}{4}$	109	
	27	3*d.*
	13|6	
	6*l.* 16*s.* 3*d. facit*	

	yds.	*d.*
$\frac{1}{8}$	573 at $1\frac{3}{8}$	
$\frac{1}{2}$	71	$7\frac{3}{8}$*l.*
	11	$11\frac{1}{4}$
	8|3	$6\frac{3}{4}$
	4*l.* 3*s.* $6\frac{3}{4}$*d. facit*	

$\frac{1}{2}$	520 *yds.* at $7\frac{1}{2}$	
$\frac{1}{4}$	260	
	65	
$\frac{1}{20}$	32|5	
	16*l.* 5*s. facit*	

$\frac{1}{2}$	137 *yds.* at $10\frac{1}{2}$*d.*	
$\frac{1}{2}$	68	6*d.*
$\frac{1}{2}$	34	3
	17	$1\frac{1}{2}$
$\frac{1}{20}$	11|9	$10\frac{1}{2}$*d.*
	5*l.* 19*s.* $10\frac{1}{2}$*d. facit*	

Case 4.

11. When the Price of the Integer is 2*s.* then cut off the Figure in the Place of Units of the given Number, and double it for Shillings, and the Figures on the other hand are Pounds. *Example.* 436 Yards at 2*s. per* Yard; cut off the laſt Figure 6, and double it, it makes 12*s.* and the two other Figures, *viz.* 43, are ſo many Pounds; ſo that their Value is 43*l.* 12*s.* as *per* Margent.

436
43*l.* 12*s.*

12. Hence it is evident, that when the given Price of an Integer is an even Number of Shillings, then if you take half of that (even Number of Shillings) and multiply the given Number of Integers thereby, doubling the firſt Figure of the Product and ſetting it apart for Shillings, the reſt of the Product will be Pounds, which Pounds and Shillings are the Value ſought. *Example.* What coſt 536 Yards at 8*s. per* Yard? To reſolve which, I take half of 8*s.* (the Price of a Yard) which is 4, and multiply 536 thereby, ſaying, 4 times 6 is 24, then I double the firſt Figure 4 makes 8 for Shillings, and carry 2 to the next Product, *&c.* I find the reſt of the Product to be 214. which I note for Pounds; ſo that the Value of 536 Yards at 8*s. per* Yard, is 214*l.* 8*s.* as by the Margent. Other Examples of the ſame Kind may be wrought after the ſame Manner.

536 *yds.* at 8*s.*
4
214*l.* 8*s.*

56

56 *yds* at 6*s.* *per* yard
16*l.* 16*s.* *facit*

123 *yds* at 4*s.* *per* yard
24*l.* 12*s.* *facit*

48 *Ells* at 8*s.* *per* Ell
19*l.* 4*s.* *facit*

84 *yds* at 10*s.* *per* yard
42*l.* *facit*

420 *yds* at 12*s.* *per* yd.
252*l.* *facit*

326 *yds* at 14*s.* *per* yd.
228*l.* 4*s.* *facit*

48 *yds* at 16*s.* *per* yard
38*l.* 8*s.* *facit*

52 *yds* at 18*s.* *per* yard
46*l.* 16*s.* *facit*

13. If the given Price of the Integer is an odd Number of Shillings, then work firſt for the even Number of Shillings, by the laſt Rule, and for the odd Shilling take $\frac{1}{20}$ of the given Number of Integers, according to the 3d Rule of this Chapter, and add them together, and you have your Deſire. Examples follow.

Yds.	*s.*		*Ells*	*s.*
422 at 3 *per* Yard			431 at 13	
l.	*s.*		*l.*	*s.*
42	4		258	12
21	2		21	11
63	6 *facit*		280	03 *facit*
Ells	*s.*		*Ells*	*s.*
516 at 7 *per* Ell			324 at 17 *per* Ell	
l.	*s*		*l.*	*s.*
154	16		259	04
25	16		16	04
180	12 *facit*		275	08 *facit*

14. Except when the given Price of the Integer is 5*s.* for then it is ſooner anſwered by taking $\frac{1}{4}$ of the given Number whoſe Value is ſought, as in the following Example.

	Yds. *s.*		*Ells* *s.*
$\frac{1}{4}$	436 at 5 *per* Yard	$\frac{1}{4}$	206 at 5 *per* Ell
	109*l.* *facit*		51*l.* 10*s.* *facit*

Caſe 5.

15. When the given Price of an Integer is Shillings and Pence, *&c.* making an even Part of a Pound, then divide the given Number of Integers, whoſe Value you ſeek, by the Denominator of that Fraction repreſenting that even Part. As for Example. What is the Price of 384 Yards at 6*s.* 8*d.* *per* Yard? Here I conſider that 6*s.* 8*d.* is $\frac{1}{3}$ of a Pound, wherefore divide 384 by 3, and the Quote is the Anſwer, *viz.* 128*l.* ſo that 384 Yards at 6*s.* 8*d.* *per* Yard, amount to 128*l.* as *per* Margent, ſtill obſerving the 7th Rule of the 9th Chapter.

$\frac{1}{3}$	384	
	128*l.* *fa.*	

More Examples follow.

1/3	438 *Ells* at 6*s*. 8*d*.	
	146*l*. *facit*	
1/6	525 at 3*s*. 4*d*.	
	87*l*. 10*s*. *facit*	
1/8	443 *Yards* at 2*s*. 6*d*.	
	55*l*. 7*s*. 6*d*. *facit*	
1/12	726 *Yards* at 1*s*. 8*d*.	
	60*l*. 10*s*. *facit*	

16. When the given Value of the Integer is Shillings and Pence, and not an even Part of a Pound, yet many times it may be divided into Parts, (*viz*. 6*s*. 6*d*. is 4*s*. and 2*s*. 6*d*.) For the 4*s*. work according to the 12th Rule foregoing, and for the 2*s*. 6*d*. take the eighth Part of the given Number, and add them together, then their Sum is the Value required.

So 8*s*. 6*d*. will be divided into 6*s*. and 2*s*. 6*d*. and the Price of the given Number may be found out as before, *&c*. Examples follow.

	yds.	*s*.	*d*
1/3	386 at 8	8	
	128*l*. 13	4	
1/10	38 12	0	
	167*l*. 5*s*. 4*d*. *facit*		

	Ells	*s*.	*d*.
s.	540 at 5	4	
2	54	0	
1/6	90	0	
	144*l*. *facit*		

	Ells	*s*.	*d*.
s.	427 at 8	6	
6	128*l*.	2	0
1/8	53	7	6
	181*l*. 9*s*. 6*d*. *facit*		

	yds.	*s*.	*d*.
s.	386 at 14	8	
8	154*l*.	8	0
1/3	128	13	4
	283*l*. 1*s*. 4*d*. *facit*		

17. When the given Price of an Integer is Shillings and Pence, and you cannot readily divide them according to the laſt Rule, then multiply the given Number whoſe Value you ſeek, by the Number of Shillings in the Price of the Integer, and then for the Pence work by the 8th Rule foregoing; then add the Numbers together, and their Sum is their Value ſought in Shillings; as for Example. What is the Value of 392 Yards at 6*s*. 9*d*. *per* Yard. Here 6*s*. 9*d*. cannot be made an even Part, nor indeed can it be divided into even Parts of a Pound; wherefore I multiply the given Number of Yards 392 by 6 for the 6*s*. the Product is 2352*s*. then for the 9*d*. I divide it into 6*d*. and 3*d*. and work for them by the 8th Rule foregoing, and at laſt add the Shillings together, they make 2646*s*. and by the third they are reduced to 132*l*. 6*s*. the Value of 392 Yards at 6*s*. 9*d*. *per* Yard. See the Work.

—39

		— 392 *yds.* at 6*s.* 9*d.*
		2352
	½	196
	¼	98
		2646
		132*l.* 6*s.* *facit*

Other Examples follow.

		l.	*s.*	*d.*
		480	at 4	10
	s.	4		
d	4	1920		
6	½	240		
4	⅓	160		
		2320		
		116*l.* *facit*		

	Ells	*s.*	*d.*
	732	at 12	7
	12		
12	8784		
4 ½	244		
3 ¼	183		
	9211		
	460*l.* 11*s.* *facit*		

In like manner may Variety of other Examples be wrought.

18. When the given Price of the Integer is Shillings, Pence, and Farthings, then multiply the given Number of Integers, by the Number of Shillings contained in the Value of the Integer, and for the Pence and Farthings follow the 10th Rule of this Chapter.

Example.

	Ells	*s.*	*d.*
	438	at 8	6¾
s.	3504		
8	219		
½	27		4½*d.*
⅛	3750		4½
	Fac. 187*l.* 10*s.* 4½*d.*		

	Ells	*s.*	*d.*
	136	at 9	2½
s.	1224	0	
9	22	8	
½	5	8	
¼	1252	4	
	Fac. 62*l.* 12*s.* 4*d.*		

	Ells	*s.*	*d.*
	370	at 14	2¾
	1480		
s.	370		
14	5180		*d.*
½	61		8
¼	15		5
½	7		8½
	5263		9½
	Fac. 263*l.* 4*s.* 9½*d.*		

	Ells	*s.*	*d.*
	431	at 2	4½
	862		
2	107		9*d.*
¼	53		10½
⅛	1023		7½
	Fac. 51*l.* 3*s.* 7½		

Case 6.

19. When the given Value of the Integer is Pounds, then multiply the Number of Integers, whose Value is ſought, by the Price of the Integer, and the Product is the Anſwer in Pounds.

Examples.

C. l.	C. l.
42 at 2 *per C.*	13 at 8 *per C.*
84 *l. facit*	104 *l. facit*
C. l.	C. l.
30 at 3 *per C.*	48 at 12 *per C.*
90 *l. facit*	576 *l. facit*

Case 7.

20. If the Price of the Integer is Pounds and Shillings, then for the Pounds work as in the laſt Rule, and for the Shillings as in the 12th and 13th Rules foregoing; then add the Numbers produced from them both, and the Sum is the Value ſought.

Examples.

	C. l. s.			Groſs l. s.	
	46 at 2 4			82 at 4 10	
2*l.*	92 *s.*		4*l.*	328	
4*s*	9 4		10*s.*	41	
	101 4			369*l. facit*	
	Groſs l. s.			Groſs l. s	
	58 at 3 7			26 at 3 15	
3*l.*	174 *s.*		3*l.*	78	
6*s*	17 8		14*s.*	18 4	
1*s*	2 18		1*s.*	1 6	
	194*l.* 6*s. facit*			97*l.* 10*s. facit*	

21. When the given Price of an Integer conſiſts of Pounds, Shillings, Pence and Farthings, then work for the Shillings, Pence and Farthings firſt, according to the 18th Rule of this Chapter, and find the total Value of the given Number, as if there were no Pounds, then work with the Pounds, according to the 19th Rule of this Chapter, and add the Numbers thus found, and their Sum is the total Value required.

Examples

Examples of this Rule follow.

	C.	l.	s.	d.
	213 at	1	13	4½
	639			
	213			
13 s.	2769		d.	
3 d.	53		3	
1½ d.	26		7½	
	284	8	10½	
	142 l.	08 s.	10½ d.	
1 l.	213			
	355 l.	08 s.	10½ d.	*facit*

	Groſs	l.	s.	d.
	416 at	2	9	3¾
9 s.	3744			
3 d.	104			
¾ d.	26			
	3874			
2 l.	193 l.	14 s.		
	832			
	1025 l.	14 s.		*facit*

	C.	l.	s.	d.
	37 at	3	8	10½
296	d.		8 s.	
18	6		6 d.	
9	3		3 d.	
4	7½		1½ d.	
32	8	4½		
16 l.	8 s.	4½ d.		
111			3 l.	
127 l.	8 s.	4½ d.	*facit*	

	Groſs	l.	s.	d.
	48 at	3	15	11¼
240				
48				
720			15 s.	
24			6 d.	
16			4 d.	
6			1½ d.	
760				
38	6			
144			3 l.	
182 l.	6 s.		*facit*	

22. When there is given the Value of an Integer, and it is required to know the Value of many ſuch Integers together, with ¼ or ½ or ¾ of an Integer, then firſt (by the former Rules) find out the Value of the given Number of Integers, and then for ¼ of an Integer, take ¼ of the given Value of the Integer, or for ½ take ½ of the given Value of the Integer; and for ¾ firſt take the half of the given Value, and then half of that half, ſetting each Part under the Precedent, then adding them together, their Sum will be the required Value of the Integers and their Parts.

Example.

What is the Value of 116½ Yards, at 4s. 6d. *per* Yard? To give an Anſwer; firſt, I work for the Value of 116 Yards, by the 15th Rule foregoing, and then for the half Yard, I take half of 4s. 6d. which is 2s. 3d. and add to the reſt found as before, then is that Sum the total Value of 116½ Yards at 4s. 6d *per* Yard, which I find to amount to 26l. 4s. 3d. as by the Work in the Margent. And all other Examples of this Kind are wrought the ſame Way.

yds.	s.	d.
116½ at	4	6
11 l.	12 s.	2 s.
14 l.	10 s.	2 s. 6 d.
2	3	½ *Yards*
26	4	3 *facit*

Other Examples follow.

$324\frac{3}{4}$ *yds.* at 4*s.* 10*d.*

1296		4*s.*
162		6*d.*$\frac{2}{2}$
108		4*d.*$\frac{1}{3}$
1	$2\frac{1}{4}$*d.*	$\frac{1}{4}$ *yd.*
156	7*s.* $2\frac{1}{2}$*l.*	

78*l.* 7*s.* $2\frac{1}{2}$*d. facit*

$228\frac{3}{4}$ *Ells* at 12*s.* 11*d.*

2736		12*s.*
76		4*d.*$\frac{1}{3}$
76		4*d.*$\frac{1}{3}$
57		3*d.*$\frac{3}{4}$
6	$5\frac{3}{4}$*d.*	$\frac{1}{2}$ *Ell*
3	$2\frac{3}{4}$*d.*	$\frac{1}{4}$ *Ell*
295	4 $8\frac{1}{4}$*d.*	

147*l.* 14*s.* $8\frac{1}{4}$*d. facit*

$720\frac{1}{2}$ *yds.* at 6*s.* 8*d.*

240*l.* 3*s.* 4*d. facit*

C.	*qrs.*	*lb*	*l.*	*s.*	*C.*
28	3	14	at 1	10	

28*l.*		1*l.*
14		10*s.*$\frac{1}{2}$
	15*s.*	$\frac{1}{2}$ *C.*
	7*s.* 6*d.*	$\frac{1}{4}$ *C.*
	3*s.* 9*d.*	14*l.*

43*l.* 6*s.* 3*d. facit.*

Many more Queſtions may be ſtated, and ſeveral other Rules of Practice may be ſhewn, according to the Methods of diverſe Authors, but what have been delivered here are ſufficient for the practical Arithmetician in all Caſes whatſoever.

CHAP. XXVII.

Barter.

1. BARTER is a Rule among Merchants, which (in the Exchange of one Commodity for another) informs them ſo to proportion their Rates as that neither may ſuſtain Loſs.

2. To reſolve Queſtions in *Barter*, will not be difficult to him that is acquainted with the *Golden Rule*, or *Rule of Three*, it being altogether uſed in reſolving ſuch Queſtions.

Queſt. 1. Two Merchants (*viz. A* and *B*) barter, *A* hath 13*C.* $3\frac{1}{2}$*rs.* 14*lb* of Pepper, at 2*l.* 16*s. per C.* and *B* hath Cotton at 9*d. per lb* I demand how much Cotton *B* muſt give *A* for his Pepper?

Anſwer 9*C.* 1*qr.*

Firſt find by the *Rule of Three*, or the Rules of *Practice* foregoing, how much the Pepper is worth, ſaying, if 1*C.* coſt 2*l.* 16*s.* what will 13*C.* $3\frac{1}{2}$*rs.* 14*lb* coſt?

Anſwer 38. 17*s.*

Secondly, by the *Rule of Three*, ſay, if 9*d.* buy 1*lb* of Cotton, how much will 38*l.* 17*s.* buy?

Anſwer $9\frac{1}{4}$*C.* and ſo much Cotton muſt *B* give to *A* for 13*C.*

13*C*. 3*qrs*. 14*lb* of Pepper, at 2*l*. 16*s*. *per C*. when the Cotton is worth 9*d*. *per lb*.

Queſt. 2. *A* and *B* barter, *A* hath 120 Yards of Broadcloth worth 6*s*. *per* Yard, but in the Barter he will have 8*s*. *per* Yard; *B* hath Shalloon worth 4*s*. *per* Yard. Now I demand how many Yards of Shalloon *B* muſt give *A* for his Broadcloth, making his Gain in Barter equal to that of *A*?

Anſwer 180 Yards of Shalloon.

Firſt (as in the laſt Queſtion) find out how *B* ought to ſell his Shalloon in Barter, *viz*. ſay, if 6*s*. require 8*s*. what will 4*s*. require?

Anſwer 5*s*. 4*d*.

Thus you ſee that *B* muſt ſell his Shalloon in Barter at 5*s*. 4*d*. if *A* ſell his Broadcloth at 8*s*. *per* Yard.

It remaineth now to find out how much Shalloon *B* muſt give for 120 Yards of Broadcloth; which reſolved after the Method in the firſt Queſtion of this Chapter, is found to be 180, and ſo many Yards of Shalloon muſt *B* give *A* for the 120 Yards of Broad cloth.

Queſt. 3. *A* and *B* bartered, *A* had 14*C*. of Sugar, worth 6*d*. *per lb*, for which *B* gave him 1*C*. 3*qrs*. of Cinnamon; I demand how *B* rated his Cinnamon *per lb*?

Anſwer 4*s*. *per lb*.

Queſt. 4. *A* and *B* barter, *A* hath 4 Tun of Brandy, worth 37*l*. 16*s*. ready Money, but in Barter he hath 50*l*. 8*s*. *per* Tun, and *B* giveth 21*C*. 2*qrs*. 11½*lb* of Ginger for the 4 Tun of Brandy; I deſire to know how much *B* ſold his Ginger for in Barter *per C*. and how much it is worth in ready Money?

Anſwer for 9*l*. 6*s*. 8*d*. in Barter, and it is worth 7*l*. *per C*. in ready Money.

Queſt. 5. *A* and *B* barter, *A* hath 320 Dozen of Candles at 4*s*. 6*d*. *per* Dozen, for which *B* giveth him 30*l*. in Money, and the reſt in Cotton at 8*d*. *per lb*; I demand how much Cotton he muſt give him more than the 30*l*.

Anſwer 11*C*. 1*qr*.

CHAP. XXVIII.

Queſtions in Loſs and Gain.

Q. 1. A Merchant bought 436 Yards of Broadcloth for 8*s*. 6*d*. *per* Yard, and ſelleth it again at 10*s*. 4*d*. *per* Yard; now I deſire to know how much he gained in the Sale of the 436 Yards? *Anſwer* 39*l*. 19*s*. 4*d*.

Other Examples follow.

324¾ *yds.* at 4*s.* 10*d.*

1296		4*s.*
162		6*d.*½
108		4*d.*⅓
1	2¼*d.*	¼ *yd.*
156	7*s.* 2½*l.*	

78*l.* 7*s.* 2½*d. facit*

228¾ *Ells* at 12*s.* 11*d.*

2736		12*s.*
76		4*d.*⅓
76		4*d.*⅓
57		3*d.*¾
6	5½*d.*	½ *Ell*
3	2¾*d.*	¼ *Ell*
295	4 8¼*d.*	

147*l.* 14*s.* 8¼*d. facit*

720¼ *yds.* at 6*s.* 8*d.*

240*l.* 3*s.* 4*d. facit*

C.	*qrs.*	*lb*	*l.*	*s.*	*C.*
28	3	14 at	1	10	

28*l.*		1*l.*
14		10*s.*½
	15*s.*	½ *C.*
	7*s.* 6*d.*	¼ *C.*
	3*s.* 9*d.*	14*l.*

43*l.* 6*s.* 3*d. facit.*

Many more Queſtions may be ſtated, and ſeveral other Rules of Practice may be ſhewn, according to the Methods of diverſe Authors, but what have been delivered here are ſufficient for the practical Arithmetician in all Caſes whatſoever.

CHAP. XXVII.

Barter.

1. BARTER is a Rule among Merchants, which (in the Exchange of one Commodity for another) informs them ſo to proportion their Rates as that neither may ſuſtain Loſs.

2. To reſolve Queſtions in *Barter*, will not be difficult to him that is acquainted with the *Golden Rule*, or *Rule of Three*, it being altogether uſed in reſolving ſuch Queſtions.

Queſt. 1. Two Merchants (*viz. A* and *B*) barter, *A* hath 13*C.* 3*qrs.* 14*lb* of Pepper, at 2*l.* 16*s. per C.* and *B* hath Cotton at 9*d. per lb* I demand how much Cotton *B* muſt give *A* for his Pepper?

Anſwer 9*C.* 1*qr.*

Firſt find by the *Rule of Three*, or the Rules of *Practice* foregoing, how much the Pepper is worth, ſaying, if 1*C.* coſt 2*l.* 16*s.* what will 13*C.* 3*qrs.* 14*lb* coſt?

Anſwer 38. 17*s.*

Secondly, by the *Rule of Three*, ſay, if 9*d.* buy 1*lb* of Cotton, how much will 38*l.* 17*s.* buy?

Anſwer 9¾*C.* and ſo much Cotton muſt *B* give to *A* for 13*C.*

13*C.* 3*qrs.* 14*lb* of Pepper, at 2*l.* 16*s. per C.* when the Cotton is worth 9*d. per lb.*

Queſt. 2. *A* and *B* barter, *A* hath 120 Yards of Broadcloth worth 6*s. per* Yard, but in the Barter he will have 8*s. per* Yard; *B* hath Shalloon worth 4*s. per* Yard. Now I demand how many Yards of Shalloon *B* muſt give *A* for his Broadcloth, making his Gain in Barter equal to that of *A*?

Anſwer 180 Yards of Shalloon.

Firſt (as in the laſt Queſtion) find out how *B* ought to ſell his Shalloon in Barter, *viz.* ſay, if 6*s.* require 8*s.* what will 4*s.* require?

Anſwer 5*s.* 4*d.*

Thus you ſee that *B* muſt ſell his Shalloon in Barter at 5*s.* 4*d.* if *A* ſell his Broadcloth at 8*s. per* Yard.

It remaineth now to find out how much Shalloon *B* muſt give for 120 Yards of Broadcloth; which reſolved after the Method in the firſt Queſtion of this Chapter, is found to be 180, and ſo many Yards of Shalloon muſt *B* give *A* for the 120 Yards of Broad-cloth.

Queſt. 3. *A* and *B* bartered, *A* had 14*C.* of Sugar, worth 6*d. per lb*, for which *B* gave him 1*C.* 3*qrs.* of Cinnamon; I demand how *B* rated his Cinnamon *per lb*?

Anſwer 4*s. per lb.*

Queſt. 4. *A* and *B* barter, *A* hath 4 Tun of Brandy, worth 37*l.* 16*s.* ready Money, but in Barter he hath 50*l.* 8*s. per* Tun, and *B* giveth 21*C.* 2*qrs.* 11½*lb* of Ginger for the 4 Tun of Brandy; I deſire to know how much *B* ſold his Ginger for in Barter *per C.* and how much it is worth in ready Money?

Anſwer for 9*l.* 6*s.* 8*d.* in Barter, and it is worth 7*l. per C.* in ready Money.

Queſt. 5. *A* and *B* barter, *A* hath 320 Dozen of Candles at 4*s.* 6*d. per* Dozen, for which *B* giveth him 30*l.* in Money, and the reſt in Cotton at 8*d. per lb*; I demand how much Cotton he muſt give him more than the 30*l.*

Anſwer 11*C.* 1*qr.*

CHAP. XXVIII.

Queſtions in Loſs and Gain.

Q. 1. A Merchant bought 436 Yards of Broadcloth for 8*s.* 6*d. per* Yard, and ſelleth it again at 10*s.* 4*d. per* Yard; now I deſire to know how much he gained in the Sale of the 436 Yards? *Anſwer* 39*l.* 19*s.* 4*d.*

Firſt, find out by the *Rule of Three*, or by *Practice*, how much the Cloth coſt him at 8*s.* 6*d. per* Yard, which I find to be 185*l.* 6*s.* then by the ſame Rule find out how much he ſold it for *viz.* 225*l.* 5*s.* 4*d.* then ſubtract 185*l.* 6*s.* which it coſt him, from 225*l.* 5*s.* 4*d.* which he ſold it for, and there remaineth 39*l.* 19*s.* 4*d.* for his Gain in the Sale thereof.

Otherwiſe, it may ſooner be reſolved thus; firſt find out how much he gained *per* Yard, *viz.* ſubtract 8*s.* 6*d.* which he gave *per* Yard, from 10*s.* 4*d.* which he ſold it for *per* Yard, the Remainder is 1*s.* 10*d.* for his Gain *per* Yard. Then ſay,

If 1 Yard gain 1*s.* 10*d.* what will 436 Yards gain? The Anſwer, by *Practice* or the *Rule of Three*, is 39*l.* 19*s.* 4*d* as was found before.

Queſt. 2. A Draper bought 124 Yards of Holland Cloth for which he gave 31*l.* I deſire to know how he muſt ſell it *per* Yard to gain 10*l.* 6*s.* 8*d.* in the whole Sale of 124 Yards?

Anſwer at 6*s.* 8*d. per* Yard.

Add the Price which it coſt him (*viz.* 31*l.*) to his intended Gain, (*viz.* 10*l.* 6*s.* 8*d.*) the Sum is 41*l.* 6*s.* 8*d.* Then ſay,

If 124 Yards require 41*l.* 6*s.* 8*d.* what will 1 Yard require? By the *Rule of Three* I find the Anſwer to be 6*s.* 8*d.*

Queſt. 3. A Grocer bought 3*C.* 1*qr.* 14*lb* of Cloves, which coſt him 2*s.* 4*d. per* lb, and ſold them for 52*l.* 14*s.* I deſire to know how much he gained in the whole?

Anſwer 8*l.* 12*s.*

Queſt. 4. A Draper bought 86 Kerſeys for 129*l.* I demand how he muſt ſell them *per* Piece to gain 15*l.* in laying out 100*l.* at that Rate?

Anſwer 1*l.* 14*s.* 6*d. per* Piece; for,

As 100*l.* is to 115*l.* ſo is 129*l.* to 148*l.* 7*s.*

So that, by the Proportion above, I have found how much he muſt receive for the 86 Kerſeys, to gain after the Rate of 15 *per Cent.* Then to find how he muſt ſell them *per* Piece, I ſay,

As 86 Pieces are to 148*l.* 7*s.* ſo is 1 Piece to 1*l.* 14*s.* 6*d.* which is the Number ſought.

Queſt. 5. A Grocer bought 4$\frac{1}{4}$ *C.* of Pepper for 15*l.* 17*s.* 4*d.* and (it proving to be damnified) is willing to loſe 12*l.* 10*s. per Cent.* I demand how he muſt ſell it *per* lb?

Anſwer 7*d. per* lb.

Subtract 12*l.* 10*s.* the Loſs of 100*l.* from 100*l* and there remains 87*l.* 10*s.* Then ſay,

As

As 100*l.* is to 87*l.* 10*s.* ſo is 15*l.* 17*s.* 4*d.* to 13*l.* 17*s.* 8*d.* and ſo much he muſt ſell it all for, to loſe after the Rate propounded. Then to know how he muſt ſell it *per* lb I ſay,

As 4½*C.* is to 13*l.* 17*s.* 6*d.* ſo is 1 lb to 7*d.*

Queſt. 6. A Plummer ſold 10 Fodder of Lead (the Fodder containing 19½*C.*) for 204*l.* 15*s.* and gained after the Rate of 12*l.* 10*s.* *per* 100*l.* I demand how much it coſt him *per C.*?

Anſwer 18*s.* 8*d.*

To reſolve this Queſtion, add 12*l.* 10*s.* (the Gain *per Cent.*) to 100*l.* and it makes 112*l.* 10*s.* Then ſay,

As 112*l.* 10*s.* is to 100*l.* ſo is 204*l.* 15*s.* to 182*l.* which 182*l.* is the Sum it coſt him in all; then reduce your 10 Fodders to Half Hundreds, and it makes 390. Then ſay,

As 390 Half Hundreds is to 182*l.* ſo is 2 Half Hundreds to 18*s.* 8*d.* the Price of 2 Half Hundreds, or 1*Cwt.* and ſo much it ſtood him in *per Cwt.*

Queſt. 7. A Merchant bought eight Tuns of Wine, which, being ſophiſticated, he ſelleth for 400*l.* and loſeth after the Rate of 12*l.* in receiving 100*l.* Now I demand how much it coſt him *per* Tun, and how he ſelleth it *per* Gallon to loſe after the ſaid Rate?

Anſwer. It coſt him 56*l.* *per* Tun, and he muſt ſell it at 3*s.* 11*d.* 2¹⁰⁄₂₁*qrs.* *per* Gallon, to loſe 12*l.* in receiving 100*l.*

To reſolve this Queſtion, I conſider, in the firſt Place, that in receiving 100*l.* he loſeth 12*l.* therefore 100*l.* comes in for 112*l.* laid out; wherefore, to find out how much he laid out for the whole, I ſay,

As 100*l.* is to 112*l.* ſo is 400 to 448*l.* and ſo much the 8 Tun coſt him: Then to find out how much it coſt *per* Tun, I ſay,

As 8 is to 448*l.* ſo is 1 to 56*l.* the Price it coſt *per* Tun.

Now to find how he muſt ſell it *per* Gallon, reduce the 8 Tuns into Gallons, they make 2016. Then ſay,

As 2016 Gallons is to 400*l.* ſo is 1 Gallon to 3*s.* 11*d.* 2¹⁰⁄₂₁*qrs.* the Price he muſt ſell it at *per* Gallon to loſe as aforeſaid.

Queſt. 8. A Merchant bought 8 Tun of Wine, which being ſophiſticated he is willing to ſell for 400*l.* and loſeth at that Rate 12*l.* in laying out 100*l* upon the ſame; now I demand how much it coſt him *per* Tun?

Here I conſider, that for 100*l.* laid out he received but 88*l.* wherefore to find what 8 Tuns coſt him, I ſay,

As 88*l.* is to 100*l.* ſo is 400*l.* to 454,⁸⁄₁₁, the Price it all coſt him: Then to find out how much *per* Tun, I ſay,

As 8 is to 454,⁸⁄₁₁, ſo is 1 to 56,⁸⁄₁₁, or 56*l.* 1*s.* 4*d.* 1,⁸⁄₁₁*qrs.* *per* Tun.

CHAP.

CHAP. XXIX.

Equation of Payments.

1. EQUATION of Payments, is that Rule among Merchants, whereby we reduce the Times for Payment of ſeveral Sums of Money, to an equated Time for Payment of the whole Debt, without Damage to Debtor or Creditor; and

The Rule is,

2. Multiply the Sum of each particular Payment by its reſpective Time, then add the ſeveral Products together, and their Sum divide by the total Debt, and the Quotient thence ariſing is the equated Time for the Payment of the whole Debt.

Example.

Queſt. 1. *A* is indebted to *B* in the Sum of 130*l.* whereof 50*l.* is to be paid at 2 Months, and 50*l.* at 4 Months, and the reſt at 6 Months; now they agree to make one Payment of the total Sum: The Queſtion is, what is the equated Time for Payment, without Damage to Debtor or Creditor?

To reſolve this Queſtion, I multiply each Payment by its Time, *viz.*

50*l.* multiplied by 2 Months produceth	100
50*l.* multiplied by 4 Months produceth	200
30*l.* multiplied by 6 Months produceth	180
The Sum of the Product is	480

Then I divide 480 (the Sum of the Products) by 130 (the total Debt) and the Quotient is $3\frac{8}{13}$ Months for the Time of paying the whole Debt.

Queſt. 2. A Merchant hath owing to him 1000*l.* to be paid as followeth, *viz.* 600*l.* at 4 Months, 200*l.* at 6 Months, and the reſt (which is 200*l.* at 12 Months, and he agreeth with the Debtor to make one Payment of the whole; I demand the Time of Payment without Damage to Debtor or Creditor?

600*l.* multiplied by 4 Months is	2400
200*l.* multiplied by 6 Months is	1200
200*l.* multiplied by 12 Months is	2400
The Sum of the Products is	6000

and the Sum of the Products (6000) being divided by the whole Debt (1000*l.*) quotes 6 Months for the Time or Payment of the whole Debt.

3. The

3. The Truth of the Rule is thus manifeſt, if the Intereſt of that Money which is paid by the equated Time (after it is due) be equal to the Intereſt of that Money which (by the equated Time) is paid ſo much ſooner than it is due at any Rate *per Cent.* then the Operation is true, otherwiſe not. *The Proof of the Rule of Equation of Payments.*

Example.

In the laſt Queſtion 600*l.* ſhould have been paid at 4 Months, but it is not diſcharged till 6 Months (that is 2 Months after it is all due) wherefore its Intereſt for 2 Months at 6 *per cent. per annum* is 6*l.* and then 200*l.* was to be paid at 6 Months, which is the equated Time for its Payment, therefore no Intereſt is reckoned for it, but 200*l.* ſhould have been paid at 12 Months, but it is paid at 6 Months, which is 6 Months ſooner than it ought, wherefore the Intereſt of 200*l.* for 6 Months is 6*l.* (accounting 6*l.* *per cent. per annum*) which is equal to the Intereſt of 600*l.* for 2 Months, wherefore the Work is right.

Queſt. 3 A Merchant hath owing him a certain Sum to be diſcharged at three equal Payments, *viz.* $\frac{1}{3}$ at two Months, $\frac{1}{3}$ at four Months, and $\frac{1}{3}$ at eight Months, the Queſtion is, what is the equated Time for the Payment of the whole Debt?

In Queſtions of this Nature (*viz.*) where the Debt is divided into unequal Parts) each of its Parts is to be multiplied by its Time, and the Sum of the Products is the Anſwer.

$\frac{1}{3}$ multiplied by 2 Months produceth	$\frac{2}{3}$
$\frac{1}{3}$ multiplied by 4 Months produceth	$1\frac{1}{3}$
$\frac{1}{3}$ multiplied by 8 Months produceth	$2\frac{2}{3}$
The Sum of the Products is	$4\frac{2}{3}$

which is $4\frac{2}{3}$ Months for the equated Time of Payment.

If inſtead of the Fractions repreſenting the Parts, you had wrought by the Numbers themſelves (repreſented by thoſe Parts) according to the firſt and ſecond Example, it would have been the ſame Anſwer; and ſuppoſe the Debt had been 90*l.* then $\frac{1}{3}$ of it is 30*l.* for each Payment, *viz.* at 2, 4 and 8 Months,

30*l.* multiplied by 2 Months produceth	60
30*l.* multiplied by 4 Months produceth	120
30*l.* multiplied by 8 Months produceth	240
The Sum of the Products is	420

which

which divided by 90 (the whole Debt) quoteth $4\frac{80}{90}$, or $4\frac{8}{9}$ Months, as before.

Queſt. 4. A Merchant oweth a Sum of Money to be paid $\frac{1}{3}$ at 5 Months, and $\frac{1}{4}$ at 8 Months, and $\frac{1}{4}$ at 10 Months, and he agreeth with his Creditor to make one total Payment; I demand the Time without Damage to Debtor or Creditor? Work as in the laſt Queſtion, and you will find the Anſwer to be 7 Months.

Queſt. 5. *A* is indebted to *B* 640*l.* whereof he is to pay 40*l.* preſent Money, 350*l.* at 3 Months, and the reſt, *viz.* 250*l* at 8 Months, and they agree to make an equated Time for the whole Payment; now I demand the Time?

In Queſtions of this Nature (*viz.* where there is ready Money paid) you are, in multiplying, to neglect the Money that is to be paid preſent, and work with the reſt, as is before directed, and divide the Sum of the Products by the whole Debt, and the Quote is the Anſwer; for here 40*l.* is to be paid preſent, and hath no Time allowed; and according to the Rule it ſhould be multiplied by its Time, which is 0; therefore 40 times 0 is 0, which neither augmenteth nor diminiſheth the Dividend; wherefore to proceed (according to Direction) I ſay,

350 by 3 Months produceth	1050
250 by 8 Months produceth	2000
The Sum of the Product is	3050

which divided by 640, the whole Debt, the Quote is $4\frac{49}{64}$ Months, the Time of Payment.

Queſt. 6. *A* is indebted to *B* in a certain Sum, half whereof is to be paid preſent Money, $\frac{1}{3}$ at 6 Months, and the reſt at 8 Months; now I demand the equated Time for Payment of it all?

Anſwer $3\frac{1}{3}$ Months is the Time of Payment.

Queſt. 7. *A* is indebted to *B* 120*l.* whereof $\frac{1}{3}$ is to be paid at 3 Months, $\frac{1}{4}$ at 6 Months, and the reſt at 9 Months; what is the equated Time for Payment of the whole Sum?

Anſwer at $6\frac{1}{4}$ Months.

Queſt. 8. *A* is indebted to *B* 420*l.* which is due at the End of 6 Months, but *A* is willing to pay him 140*l.* preſent, provided he can have the Remainder forborn ſo much the longer, to make Satisfaction for his Kindneſs, which is agreed upon; I deſire to know what Time ought to be allotted for the Payment of the 280*l.* remaining?

The

The Operation of this Queſtion is left to the Learner, to try his Genius, and who, in this Caſe, muſt have an Eye to the Rule of Three.

CHAP. XXX.

Exchange.

1. THE Rule of *Exchange* informeth the Merchants how to exchange Monies, Weights or Meaſures of our Country into (or for) the Monies, Weights or Meaſures of another Country, and when the Rate, Reaſon or Proportion betwixt the Money, Weights or Meaſures of different Countries is known, it will not be difficult for the Practitioner that is well acquainted with the Rule of Proportion (or *Rule of Three*) to reſolve any Queſtion, wherein it is required to exchange a given Quantity of the one Kind into the ſame Value of another Kind.

2. In Queſtions of Exchange there is always a Compariſon made between the two Coins, *&c.* of two Countries (or Kinds) or of more.

3. In Queſtions where there is a Compariſon made between two Things (whether they be Monies, Weights, *&c.*) of different Kinds, there may be a Solution found by a ſingle Rule of Three, as by the following Example.

Queſt. 1. A Merchant at *London* delivered 370*l. ſterl.* to receive the ſame at *Paris* in *French* Crowns, the Exchange $3\frac{1}{3}$ *French* Crowns *per l. Sterling*; I demand how many *French* Crowns he ought to receive?

In placing the Numbers, obſerve the 6th Rule of the 10th Chapter, which being done, the given Number will ſtand thus:

l.	*Crowns*	*l.*
1	$3\frac{1}{3}$	370

and being reduced according to the Rules of the 24th Chapter, will ſtand thus:

As $\frac{1}{1}$ is to $\frac{10}{3}$, ſo is $\frac{370}{1}$ to $1233\frac{1}{3}$.

So that I conclude he ought to receive $1233\frac{1}{3}$ *French* Crowns at *Paris* for his 370*l.* deliver'd at *London*.

Queſt. 2. A Merchant deliver'd at *Amſterdam* 587*l. Flemiſh*, to receive the Value thereof at *Naples* in Ducats, the Exchange $4\frac{4}{5}$ Ducats *per l. Flemiſh*; I demand how many Ducats he ought to receive?

The Proportion is as followeth:

l.	*Ducats*	*l.*	*Ducats*
As $\frac{1}{1}$ is to	$\frac{24}{5}$,	ſo is $\frac{587}{1}$ to	$2817\frac{3}{5}$

So

So I find he ought to receive 2817$\frac{3}{5}$ Ducats at *Naples*, for the 587*l*. *Flemiſh* delivered at *Amſterdam*.

Queſt. 3. A Merchant at *Florence* delivereth 3478 Ducatoons, to receive the Value at *London* in Pence, the Exchange at 53$\frac{1}{2}$*d. ſterling per* Ducatoon; I demand how much *ſterling* he ought to receive?

The Proportion for Reſolution is,

Ducats *d.* *Ducats* *d.*

As $\frac{1}{1}$ is to $\frac{107}{2}$, ſo is $\frac{3478}{1}$ to 186073

which is equal to 775*l*. 6$\frac{1}{12}$ for the Anſwer.

4. When there is a Compariſon made between more than two different Coins, Weights or Meaſures, there ariſeth ordinarily two different Caſes from ſuch a Compariſon.

1. When it is required to know how many Pieces of the firſt Coin, Weight or Meaſure are equal in Value to a known Number of Pieces of the laſt Coin, Weight or Meaſure.

2. When it is required to find out how many Pieces of the laſt Coin, Weight or Meaſure are equal in Value to a given Number of the firſt Sort of Coin, Weight or Meaſure.

An Example of the firſt Caſe may be this, *viz.*

Queſt. 4. If 150 Pence at *London* are equal to 3 Ducats at *Naples*, and 4$\frac{4}{5}$ Ducats at *Naples* make 34$\frac{1}{2}$ Shillings at *Bruſſels*? then how many Pence at *London* are equal to 138*s*. at *Bruſſels*? *facit* 960*d*.

The Queſtion may be reſolved by two ſingle Rules of Three: For firſt, I ſay,

If $\frac{3}{1}$ Ducats at *Naples* make 150*d*. at *London*, how many Pence will 4$\frac{4}{5}$ Ducats make? *Anſwer* 240*d*.

By the foregoing Proportion we have diſcovered, that 4$\frac{4}{5}$ Ducats at *Naples* make 240 Pence at *London*; and by the Tenor of the Queſtion we ſee, that 4$\frac{4}{5}$ Ducats at *Venice* make 34$\frac{1}{2}$ Shillings at *Bruſſels*; therefore 240*d*. at *London* are equal to 34$\frac{1}{2}$*s*. at *Bruſſels* (for the Things that are equal to one and the ſame Thing, are alſo equal to one another) wherefore we have a Way laid open to give a Solution to this Queſtion by another Single Rule of Three, whoſe Proportion is,

As 34$\frac{1}{2}$*s*. at *Bruſſels* is to 240*d*. at *London*, ſo is 138*s*. at *Bruſſels* to 960*d*. at *London*; which is the Anſwer to the ſecond Queſtion.

An Example of the ſecond Caſe may be this, *viz.*

Queſt. 5. If 40*lb Averdupois-weight* at *London* is equal to 36*lb* weight at *Amſterdam*, and 90*lb* at *Amſterdam* makes 116*lb* at *Dantzick*; then how many Pounds at *Dantzick* are equal to 112*lb Averdupois-weight* at *London*?

Anſwer

Anſwer $129\frac{23}{28}$*lb* at *Dantzick*.

This Queſtion is likewiſe anſwered by two ſingle Rules of Three, *viz.* Firſt, I ſay,

As 36*lb* at *Amſterdam* is to 40*lb* at *London*,
So is 90*lb* at *Amſterdam* to 100*lb* at *London*.

And by the Queſtion you find, that 90*lb* at *Amſterdam* is equal to 116*lb* at *Dantzick*, and therefore 100*lb* at *London* is likewiſe equal thereunto; wherefore again I ſay,

As 100*lb* at *London* is to 116*lb* at *Dantzick*,
So is 112*lb* at *London* to $129\frac{23}{28}$*lb* at *Dantzick*.

By which I find, that $129\frac{23}{28}$*lb* at *Dantzick* are equal to 112*lb* *Averdupois-weight* at *London*.

5. There is a more ſpeedy Way to reſolve ſuch Queſtions as are contained under the two Caſes before-mentioned, laid down by Mr. *Kerſey* in the third Chapter of his Appendix to *Wingate*'s Arithmetick, wherein he hath given two Rules for the Reſolution of the Queſtions pertinent to the ſaid Caſes.

6. But I ſhall lay down a general Rule for the Solution of both Caſes; and 1ſt, Let the Learner obſerve the following Directions in placing of the given Terms, *viz.*

7. Let there be made 2 Columns, and in theſe Columns ſo place the given Terms one over the other as that in the ſame Column there may not be found 2 Terms of the ſame Kind one with the other.

Having thus placed the Terms, the general Rule is,

Obſerve which of the ſaid Columns hath the moſt Terms placed in it, and multiply all the Terms therein continually, and place the laſt Product for a Dividend; then multiply the Terms in the other Column continually, and let the laſt Product be a Diviſor; then divide the ſaid Dividend by the ſaid Diviſor, and the Quotient thence ariſing will be the Anſwer to the Queſtion.

So the Example of the firſt of the ſaid Caſes being again repeated, *viz.* if 150 Pence at *London* make 3 Ducats at *Naples*, and $4\frac{4}{5}$ Ducats at *Naples* make $34\frac{1}{2}$ Shillings at *Bruſſels*, then how many Pence at *London* are equal to 138 Shillings at *Bruſſels*?

The Terms being placed according to the 7th Rule will ſtand as followeth:

	A	B	
Pence at *London*.	150	3	Ducats at *Naples*
Ducats at *Naples*	$4\frac{4}{5}$	$34\frac{1}{2}$	Shillings at *Bruſſels*.
Shillings at *Bruſſ.*	138		

Having thus placed the Terms that in neither Column there are not two Terms of one Kind, then obſerve that the

the Column under A hath moſt Terms in it, therefore they muſt be multiplied together for a Dividend, *viz.* 150 multiplied by $4\frac{4}{8}$ produceth $^{3600}\frac{8}{8}$, which multiplied by 138 produceth $^{496800}\frac{8}{8}$ for a Dividend; then in the Column under B there are 3 and $34\frac{1}{2}$, which multiplied together produce $^{207}\frac{2}{2}$ for a Diviſor; then having divided $^{49600}\frac{8}{8}$ by $^{207}\frac{2}{2}$, the Quotient is 960 Pence for the Anſwer, as before.

Again, Let the Example of the ſecond Caſe be again repeated, *viz.* if 40*lb Averdupois-weight* at *London* make 36*lb* weight at *Amſterdam*, and 90*lb* at *Amſterdam* make 116*lb* at *Dantzick*, then how many Pounds at *Dantzick* are equal to 112*lb Averdupois-weight* at *London*.

The Terms being diſpoſed according to the 7th Rule foregoing, will ſtand thus:

	A	B	
lb at *London*	40	36	*lb* at *Amſterdam*.
lb at *Amſterdam*	90	116	*lb* at *Dantzick*.
		112	*lb* at *London*.

Whereby I find that the Terms under B multiplied together produce 467712 for a Dividend, and the Terms under A, *viz.* 40 and 90, produce 3600 for a Diviſor, and Diviſion being finiſhed, the Quotient giveth $129\frac{3312}{3600}$*lb* at *Dantzick* for the Anſwer.

CHAP. XXXI.

Single Poſition.

1. NEgative Arithmetick, called the *Rule of Falſe*, is that by which we find out a Truth, by Numbers invented or ſuppoſed, either ſingle or double.

2. The Rule of Single Poſition is, when at once, *viz.* by one falſe Poſition, or feigned Number, we find out the true Number ſought.

3. In the *Single Rule of Falſe*, when you have made choice of your Poſition, work it according to the Tenor of the Queſtion, as if it were the true Number ſought; and if by the ordering your Poſition you find either the Reſult too much or too little, you may then find out the Number ſought by this Proportion following, *viz.*

As the Reſult of your Poſition is to the Poſition, ſo is the given Number to the Number ſought.

Example.

Queſt. 1. A Perſon having about him a certain Number of Crowns, ſaid, if a 4th, 3d and 6th of them were added together

Operation of ſuch Queſtions being more applicable to Decimals, are omitted, till we come to acquaint the Learner therewith.

LAUS DEO SOLI.

A few Additional Queſtions for the Exerciſe of Learners, in the ſeveral foregoing Rules.

1. AN old whimſical Gentleman having 5 Daughters, left them a conſiderable Fortune which he bequeathed in manner following. The Sum of the Fortunes of the four eldeſt was 25000*l.* the Sum of the four laſt 33000*l.* the Sum of the three laſt with the firſt 30000*l.* the Sum of the three firſt with the laſt 28000*l.* and the Sum of the two laſt with the two firſt 32000*l.* Now the Queſtion is how much was each particular Daughter's Fortune?

2. *B* and *C* working jointly can finiſh a Boat in 18 Days; with the Aſſiſtance of *A* they can do it in 11 Days. Now in what Time could *A* perform the ſame, working alone?

3. *X*, *Z* and *Y*, working together, can complete a Staircaſe in 12 Days, *Z* is Man enough to do the ſame alone in 24 Days, and *X* in 34. Now in what Time could *Y* alone get it done?

4. What Number is that, to which, if $\frac{3}{10}$ of $\frac{18}{7}$ of $\frac{141}{213}$ be added, the Total will be 1?

5. It is propoſed by an elderly Perſon in Trade, to admit a ſober induſtrious young Fellow to a Share in the Buſineſs; and, to encourage him offers, that if his Circumſtances will allow him to advance 100*l.* his Pay ſhall be 40*l.* *per annum*; if he be able to advance 200*l.* in Stock, he ſhall have 55*l.* a Year; and if 300*l.* he ſhall receive 70*l.* a Year. In this Propoſal I deſire to know what is allowed the young Man for his Attendance ſimply?

6. If 15 Birds coſt in all 5*s.* whereof there were Partridges at 7*d.* Quails at 5*d.* and Larks at 2*d.* How many were there of each?

7. A Mixture was made of 10 Gallons of Wine, 4 Gallons of Brandy and 12 Gallons of Water: Out of the whole was drawn 8 Gallons, and as much Water put in to fill it up: Then was drawn out 10 Gallons, after which was put in 6 Gallons of Wine; Again there was drawn out

out 5 Gallons, and 3 Gallons of Brandy put in, How much Wine, Brandy, and Water each is at laſt in the Mixture?

8. There was a Fiſh caught whoſe Head was $7\frac{3}{4}$ Inches long, its Tail was as long as the Head and half its Body, and the Body was exactly the Length of both Head and Tail: How long was the whole Fiſh?

9. A Man at a Country Fair had a mind to a String of 25 fine Horſes; but not caring to take them at 20 Guineas *per* Head, the Jockey agreed to let him have them as follows, that was, the firſt Horſe for a ſingle Farthing, the ſecond for an Halfpenny, the third for a Penny, the fourth for Two-pence, and ſo on, doubling the Price of each Horſe to the laſt; Now I demand the Price of the 25th Horſe; and of all the reſt added together?

10. There is an Army to which if you add $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ of itſelf and take away 5000, the Sum Total will be 100000, What is the Number of the whole Army?

11. Suppoſe a Dog, a Wolf and a Lion, were to devour a Sheep, and that the Dog could eat the Sheep in an Hour, the Wolf in $\frac{3}{4}$ Hour, and the Lion in $\frac{1}{2}$ Hour; Now if the Lion began to eat $\frac{1}{8}$ Hour before the other two, and afterwards all three eat together, the Queſtion is, in what time the Sheep would be devoured?

12. There are 100 Stones which lie, in a Line, on the Ground, three Feet aſunder, and there is one employ'd to gather up the Stones one by one, and bring them to a Basket which ſtandeth three Feet from the firſt Stone; How many Yards muſt he go backwards and forwards in all, before he hath brought the laſt Stone to the Basket?

13. Two Boon Companions, *Gouty* and *Fiſh*, are to have (if they can divide it) equal Shares of eight Gallons of Wine, now lying in a Veſſel containing exactly eight Gallons: But to make this Partition they ſhall have only two other empty Veſſels, the one containing five, and the other three Gallons; how ſhall they manage to divide the ſaid Wine?

F I N I S.

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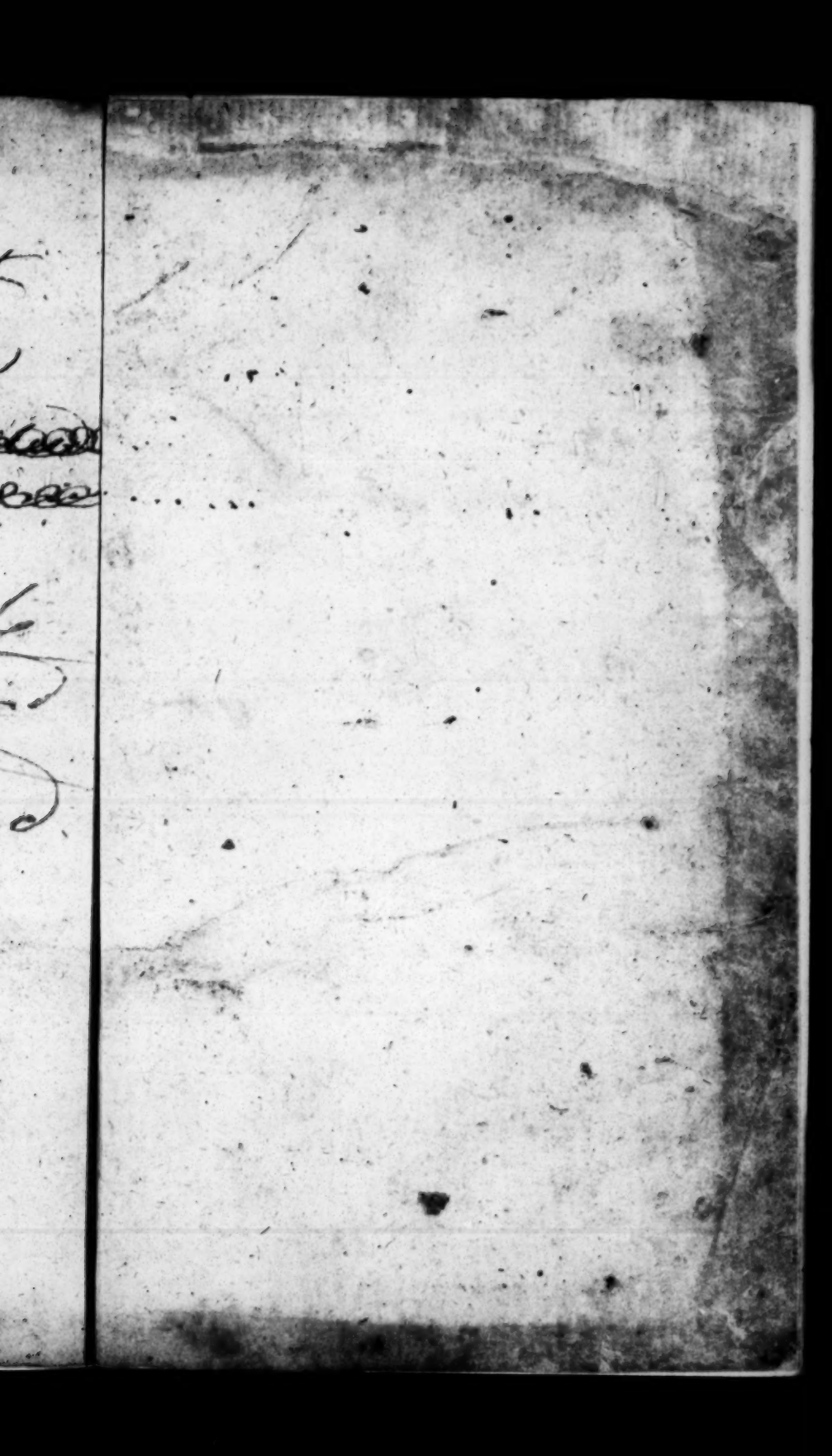

Wm & Ed Dunn's
Book dated the 10th
April 1832 — No 4
Fleet Street Dublin